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People & the Planet

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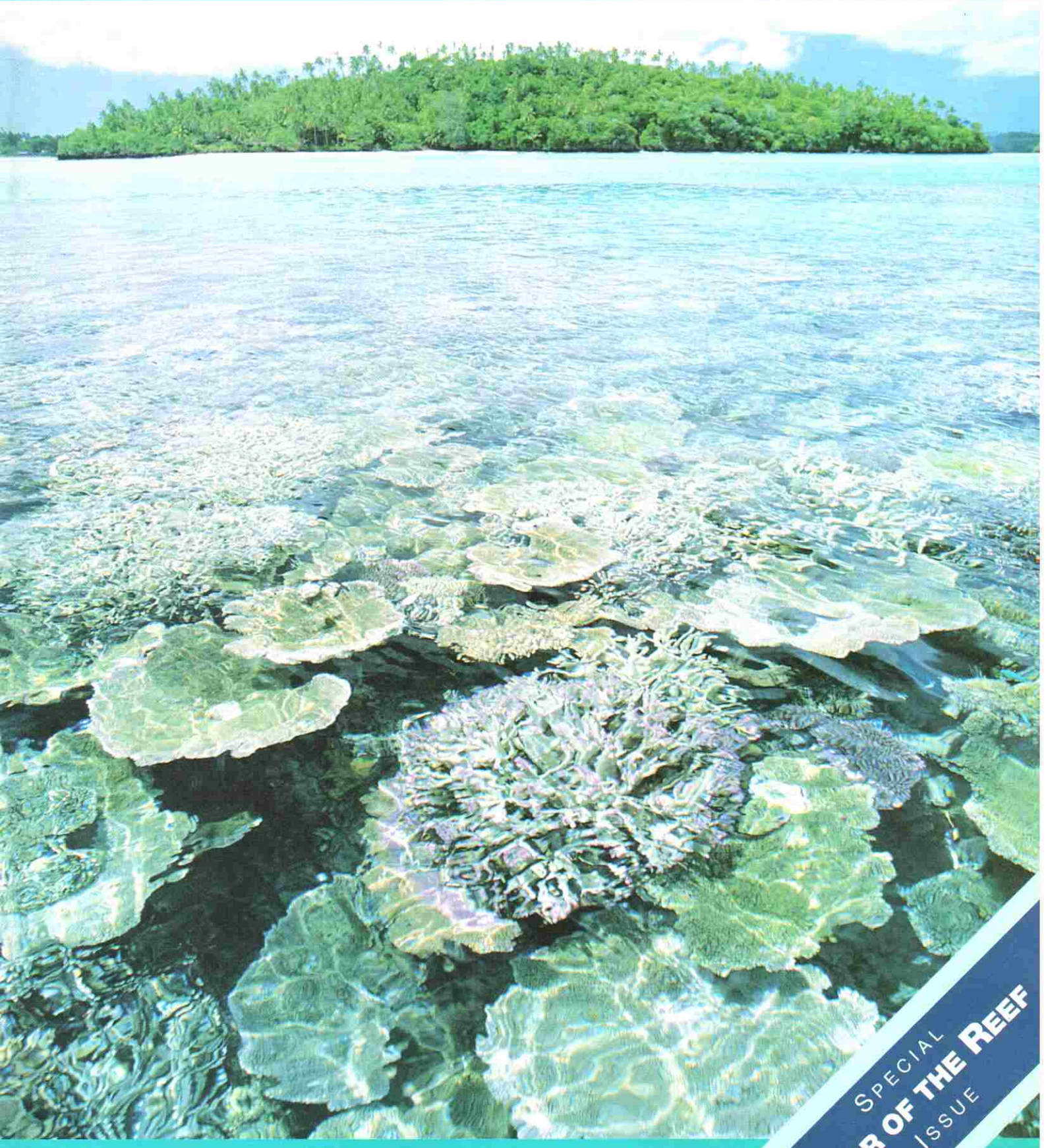

CORALS IN CRISIS

SPECIAL
YEAR OF THE REEF
ISSUE

Front cover: Coral reef and palm covered island, Mala, Vava'u Tonga, South Pacific
Credit: Pete Atkinson/Planet Earth Pictures
Left: Soldier fish in coral reef, French Polynesia
Credit: WWF/Y.Lefevre/Bios

People & the Planet

Contents

Newsfile.....page **4**

Coral reefs in crisis: Don Hinrichsen reports on the state of the world's reefs and explains how local communities can help to manage and protect them.....page **6**

What price a reef fish dinner?: Robert Ginsburg and William Kiene outline what the International Year of the Reef hopes to achieve.....page **12**

Protecting a marine wonderland: Sue Wells reports from Belize on the impressive effort now being mounted to protect the unique coastal riches of the Western Hemisphere's largest barrier reef.....page **14**

Australian treasure: Graeme Kelleher considers the past and future of the world's largest coral reef complex, the Great Barrier Reef.....page **17**

Putting an end to coral mining: Lynne Zeitlin Hale reports from Sri Lanka on a success story in coastal management .....pages **20**

Reclaiming the island reefs: In far-flung Philippine islands more communities are joining the battle to manage and conserve their coral reefs and coasts reports Linda Bolido and Alan White.....page **22**

Silencing the dynamite fishers: Solomon Makoloweka and Kath Shurcliff report from Tanzania on a new partnership between villagers and government to save the coral reefs.....page **24**

Building a sense of stewardship: Yves Renard and Allan Smith on the urgent efforts to create greater community involvement in the conservation of the coral reefs of the Caribbean...page **26**

Taming the seahorse trade: Amanda Vincent's study of seahorses and the threat to their existence...page **28**

Coral Reefs and the World Bank: Marea Hatziolos on the growing role of the World Bank.....page **30**

The ethic of stewardship: The last word by Stephen Olsen and Magnus Ngoile.....page **32**

Associates' news.....page **33**

Book & film reviews.....page **34**

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Hidden holocaust

Hidden beneath the shining sea, a vast triangle of underwater coral straddling the islands of the Philippines, Indonesia and Papua New Guinea, is being systematically poisoned. According to the International Marine Alliance over 6,000 divers squirt some 150,000 kilograms of dissolved poison onto some 33 million coral heads in the Philippines alone each year. In one eight month-period it estimated that over US$800,000-worth of coral fish was exported to supply the dinner tables of Hong Kong and Taiwan, not to mention the huge trade in decorative fishes for aquariums of the world. The fish, it seems, can expel the poison from their systems once stunned and caught, but the bountiful cities of coral, teeming with life that is even richer in its diversity than the rainforests of the land, are left bleached and dead. The Philippine Government and others are now battling against this and other threats to the coral reefs, but are up against the hidden nature of the problem. In the words of Rodney Salm, in a previous issue of this magazine, "the inscrutable sea surface hides the real riches from view."

That is the reason why this year has been declared the International Year of the Reef and why this magazine is devoting an entire issue to the problem. As Don Hinrichsen and others explain, the war on coral is waged not just with poison, but with dynamite, fine mesh nets, smothering sediment from a million building sites, the sewage and waste from coastal towns and tourist hotels, polluting industries and upstream logging, the dredging of trawlers and the dumping from oily bilges, the feet and anchors of divers and dive boats and those who smash the coral into building material. The victims of this destruction are not only the living corals and the fish they sustain, but the local communities who rely on the fish for their livelihoods, the growing populations who depend upon the protein of the sea for their survival, coastal people whose protection from floods and storms depend upon the protection of the living reefs and all who marvel at this natural treasurehouse.

Fortunately, we are able to report many happy stories alongside the sad ones. In the Philippines, local communities are discovering that they can defend their own resources and bring the reefs back to productive life. In Belize and elsewhere, coastal management plans are building on the successful experience of Australia's Great Barrier Reef Marine Park, and adapting the lessons learnt there to local circumstances. In Sri Lanka, coral mining for limestone has been largely halted and in the Tanga region of East Africa dynamite fishing has been almost entirely silenced through a collaborative effort involving government agencies, local government and local fishing communities, with technical help from the World Conservation Union (IUCN). As all our contributors agree, the hopeful way ahead is to match the growing awareness of the problem with action at all levels, but above all by fostering a sense of stewardship for a most precious and beautiful resource.

John Rowley

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The following 'associates' are partners in the development and distribution of *People & the Planet:* AVSC International, Audubon, Center for Communication Programs, John Hopkins School of Public Health, Earthwatch, Centre for Development and Population Activities, Family Health International, Futures Group, International Institute for Environment and Development, International Union for the Scientific Study of Population, Pathfinder International, Population Action International, Population Concern, Population Reference Bureau, Royal Swedish Academy of Sciences, Television Trust for the Environment, WWF-Alliance for Religions and Conservation.

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GOOD NEWS FOR 2050

The world's population in 2050 is expected to be 9.4 billion, according to the new UN medium population projection. This is good news: it is a massive 466 million less than the last projection done in 1994 – and 652 million less than the long range projection made in 1992, *writes Paul Harrison.*

The annual increase for the 1990s is still high – an average of 81 million each year. But it is nearly a Switzerland a year less than the 87 million estimated in 1994, and a Netherlands a year less than the 97 million estimated in 1992.

The main reason for the changes is that childbearing has fallen faster than previously expected in many countries – and fallen lower than expected in developed countries. The typical lifetime number of children per woman in developed countries in 1995-2000 is 1.59 – 6.5 per cent less than expected in the 1994 projection, and well below the 2.1 necessary for replacement. For developing countries the total fertility rate is 3.1 – 11.5 per cent lower than expected in 1994.

Zhen Xue Qing

Almost all regions are projected to have lower populations than the 1994 projection expected. The biggest differences are in South Asia, where 2050 population is expected to total 2,521 million (152 million less than in the 1994 projection). Here India and Bangladesh have both seen fertility fall much faster than expected – it currently stands at around 3.1 for both countries. The global low population projection for 2050 is now 7.66 billion (255 million less than in the 1994 projection) and the high projection 11.2 billion (756 million less than expected in 1994).

So far, the long-term record of UN population projections has been remarkably good. That may not remain so in the future. It is quite possible that future projections will continue to lower the totals expected for 2050. The reason is that the medium projection assumes that fertility will not drop below the replacement level of 2.1 in countries where it is now above that level. In countries where fertility is below 2.1, the medium projection assumes that it will rise again back to 2.1.

This assumption has a bigger and bigger effect on projected totals as the years advance. By the year 2025, most countries outside Africa are clocked in at an unchanging fertility rate of 2.1, right up to 2050, or rising towards 2.1. These figures are no longer projections, but assumptions. Events will almost certainly prove them wrong.

For example, all countries in Eastern Asia, except Mongolia, are now at or below replacement level. Here the medium projection expects fertility to rise from an average of 1.78 in 1995-2000, to 2.1 by 2040-45. All European countries except Malta, Albania and Iceland are below replacement fertility, often far below, but the average fertility is assumed to rise from 1.45 now to 2.03 in 2045-2050.

Yet many trends in both these regions are pushing to lower fertility, while few are pushing to raise it. Individualistic consumption is growing, urbanization is increasing housing shortages and congestion, and women are delaying marriage and childbearing in favour of work and more education.

If fertility does not stick at replacement level, then the 2050 totals will be lower than is now expected – possibly as much as 450 million lower for East Asia and Europe alone. There may be more good news on the population front in years to come.

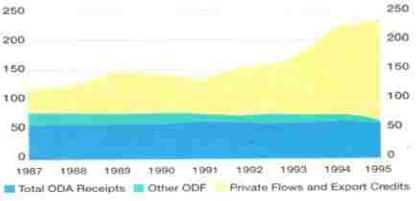
RICH AND POOR

The latest report on Development Co-operation, published in February by the Paris-based Organisation for Economic Co-operation and Development (OECD), shows that total aid from rich to poor countries, measured in constant 1994 prices, has fallen for the first time.

Total aid in 1995 was $59 billion, more than 9 per cent less than in 1994. Fourteen of the 21 donor countries reduced their aid, all but four contributing less than the agreed target of 0.7 per cent of GNP. The four exceptions at the top of the donor league are Denmark, Norway, Netherlands and Sweden. At the bottom is the United States which gave only 0.1 per cent of aid as a percentage of GNP. The largest volume of aid, by far, came from Japan, which gave $14.5 billion, followed by France ($8.4 billion), Germany (7.5 billion) and the United States ($7.4 billion).

However, in presenting the 1996 OECD report to a meeting in London, the Chairman of the Development Assistance Committee (DAC), James Michel, pointed out that total monetary flows to developing countries had reached an all-time high of $240 billion, thanks mainly to increased investments in upper middle income countries, especially in Asia.

In 1995 developing countries received around $160 billion in private funds, compared to $70 billion in aid and concessionary loans. However, the poorest countries saw a continuing decline in funds from the rich world, even including private investment.

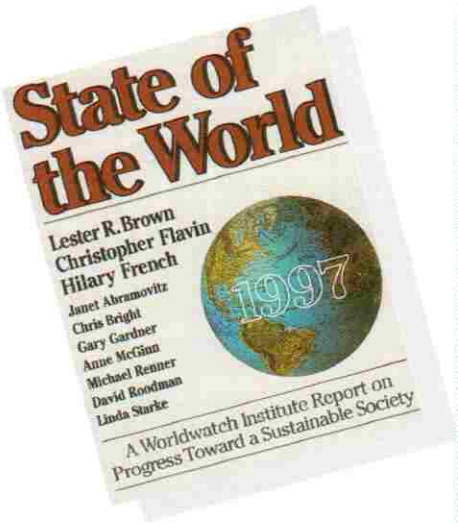


FIVE YEARS ON

Five years after the historic 'Earth Summit' in Rio de Janeiro, the world's governments are falling short of the goals agreed by more than 100 world leaders, says the latest report from the Worldwatch Institute.

"Since Rio, human numbers have grown by 450 million, vast areas of forest have been stripped of trees, and annual emissions of carbon dioxide from fossil fuels, the leading greenhouse gas, have climbed to all-time highs, altering the very composition of the atmosphere," reports *State of the World 1997*.

The major Rio treaties, the Framework Convention on Climate Change and the Convention on Biological Diversity, have not been adequately implemented so far, threatening the stability of the planet's climate and natural ecosystems, says the report. It points to the 1987



Montreal Protocol, which has reduced production of CFC gases that damage the ozone layer by more than 75 per cent, as the kind of tough legally binding agreement that is needed to address other global environmental problems.

State of the World singles out eight nations that most shape the global environment. These 'heavyweights' are China, India, the United States, Indonesia, Brazil, Russia, Japan, and Germany. Together, they have 56 per cent of the world's population and 53 per cent of its forests, and emit 58 per cent of the carbon dioxide. These eight nations have "the fate of the earth in their hands."

Unfortunately, says the report United States' environmental leadership has faded in the five years since Rio. The US senate has not even ratified the convention on Biological Diversity, and the country is failing to meet the emissions targets in the Climate Convention by a wide margin. US funding for international environmental and population programmes has also been cut:

"Since 1992, Germany and other European countries have taken the lead on many international environmental issues, including a strong push to strengthen the climate convention."

Developing countries are increasingly key to the health of the global environment, the report finds. By1995, for example, China already consumed more coal, grain and red meat than the United States. It is the world's number two emitter of carbon dioxide, and its air pollution is spreading as far as Japan and South Korea. Ironically, it may be China, India and other developing nations that finally force the United States and other industrial countries to come to terms with the fact that their own economies are not sustainable.

State of the World 1997 is published by W. W. Norton in New York at $13.95pb and by Earthscan in London at £12.95pb.

WATER PERIL

Huge areas of the planet are likely to face severe water shortages in the next 30 years if current trends in water use persist, according to two new United Nations reports.

The situation not only imperils human health and development on a vast scale, says the UN, but also aquatic and terrestrial ecosystems on which much of the Earth's life depends:

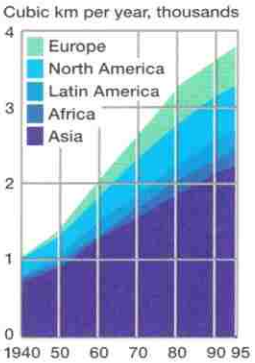
"There is clear and convincing evidence that the world faces a worsening series of local and regional water quantity and quality problems, largely as a result of poor water allocation, wasteful use of the resource, and a lack of adequate management."

At present, over a quarter of the planet's population has to struggle to get enough water to drink, grow food and run industry, say the documents which have been prepared for the five-year reassessment of the Earth Summit, in June. "By 2025, as much as two-thirds of the world population would be under stress conditions."

Water use is growing faster than population growth, at 2.5 per cent a year, and has risen six-fold during this century. By 2025, if all humanity is to have access to safe drinking water and sanitation, the needs of an additional 5 billion people will have to be met, the UN estimates.

It calls for an international consensus on severity of the water crisis and higher priority in national planning on water management. Unfortunately the countries most at risk are also the poorest.

Comprehensive Assessment of the Freshwater Resources of the World *and* Global Change and Sustainable Development: Critical Trends, United Nations, 1997



MARINE DANGERS

Whales and dolphins – even those protected from the harpoon – are facing long-term threats from the combined onslaught of pollution, overfishing, ozone depletion and now, for the first time, climate change.

Drawing on the latest findings of the International Panel on Climate Change (IPCC) and other scientists, a report in *Earth Island Journal* says the anticipated increase in global temperature during the next century could alter the underwater world and cause an environmental crisis for marine wildlife.

It argues that shifting patterns of food availability and diminishing habitat will compound the effect of increasing levels of pollution and the proliferation of toxic algae blooms. Unfavourable environmental conditions will foster cetacean disease.

Arctic ice is expected to decrease by one-third, extending the ice-free season from 41 to 100 days, leaving the Arctic Ocean's coastline vulnerable to exploitation by shipping and extractive industries. Receding Antarctic ice will shrink krill habitat and populations – the backbone of the ecosystem and exclusive food supply for many whale species.

UV-B radiation pouring through the polar ozone holes will reduce healthy growth of phytoplankton – microscopic food for marine life – by as much as 20 per cent.

At the same time, existing pollution levels may intensify as rising sea levels increase coastal rainfall and manipulate circulation patterns. Surface runoff from heavy rains could drag greater quantities of nutrients, organochlorins and heavy metals into rivers. Overwashed waste sites and sewers could also leak toxins, sewage, bacteria and viruses into the seas. And the rising ocean level could destroy wetlands – Earth's natural water-filtering system.

Warmer water temperatures and nutrient loads would encourage red tides – phytoplankton population explosions that promote bacterial growth, suffocating fish and potentially poisoning shellfish.

Climate change also threatens to foster new and existing diseases, says the report. New viruses, bacteria and parasites are likely to drift to coastal areas and tropical viruses to spread northwards to areas without natural resistance.

Finally, ice-cap recession threatens the precise balance of ocean currents established over thousands of years as water moves from the surface to the sea floor. If this is upset, the entire physical system of the marine environment, upon which all marine life depends, will change.

Such environmental factors need to be taken into account by the International Whaling Commission when planning its work, the report urges.

Climate Change Threatens Whales, appeared in the Fall 1996 issue of *Earth Island Journal* and is distributed by *Third World Network Features*.

James D. Watt/Planet Earth Pictures

Coral reefs

Don Hinrichsen, environmental journalist and author, has explored coral reefs around the world for his latest book on coastal ecosystems. Here he reports on the crisis facing reefs and the struggle to save them.

On tiny Apo Island, off the southern coast of Negros in the Philippines, a sudden squall has chopped a becalmed sea into angry white caps. Our small dugout canoe rocks furiously back and forth as the waves march shoreward in military fashion, tossing us up and down like a cork. Without our outrigger for balance, the narrow craft would have capsized. Luckily, Jesus Delmo, President of the Apo Island Marine Management Committee, had just hauled in a full grown jack, its silver body still flopping in the bottom of the canoe. Delmo, his army fatigues already soaked, is all smiles as he quickly fires up the outboard motor. We head back towards shore, the waves pushing us relentlessly from behind. "Hang on," he yells, "this is going to be rough."

As we near Apo, it is clear that we cannot possibly land on the windward side of the island. The surf has turned jagged; waves tumbling in upon each other. We run for the leeward side, and finally haul the outrigger up on the beach. Both of us are drenched to the skin, but exhilarated.

By now the squall has turned into a full force gale, bending the palm trees that fringe the island into right angles. We take shelter in his house, elevated on stilts, fashioned mostly from bamboo and odd pieces of lumber. "Don't worry," jokes Delmo, "the last typhoon that tore through here took most houses, but not this one!"

In an hour the gale has passed, and the Mindanao Sea is once again smooth as glass. Delmo is already cleaning the jack, one of Southeast Asia's tastiest reef fish, for tonight's dinner.

A decade ago, such a catch would have been wishful thinking. In the mid-1980s there were few fish in Apo's over-exploited waters. In an effort to pull a living from the sea, Apo's 100 fishing families had pulverized and over-fished the 106-hectare coral reef that surrounds the island and provides Apo Islanders with food.

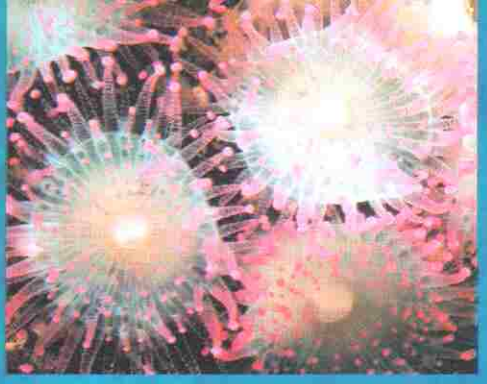
In 1984, facing the grim prospect of abandoning their homes and moving to the main island of Negros, help came in the form of two social workers and a team of marine biologists from nearby Silliman University in Dumaguete City. Their message was unequivocal: in order to rebuild their resources and their lives, they needed to manage their reef on a more sustainable basis. Protecting a small portion of their colourful reef from all forms of exploitation would help restore balance to the rest of the ecosystem, allowing fish stocks to recover.

"At first, we thought they were crazy," recalls Delmo, "we had no idea how reefs function. But at that point, we had nothing to lose, we were already travelling 30 kilometres across the sea, at great personal risk, to fish off the coast of Mindanao."

In 1986, Apo islanders voted overwhelmingly to set aside just eight per cent of their entire reef as a reserve, where no activities of any kind would be permitted, except scuba diving and snorkelling.

"It was the best decision we ever made," beams Delmo. "Within two years (by 1988) stocks of edible fish and shellfish

in crisis



Norbert Wu/Planet Earth Pictures

had recovered to such as extent that we could catch all the fish we needed around our own island again."

Cities under the sea

The dramatic recovery on Apo - just a pinprick on the map - is the kind of story that catches the attention of experts who follow the tragic decline of the world's coral resources. From Palau in the South Pacific to Australia, south Florida to the Ryukyu archipelago of Japan, coral reefs – the rainforests of the sea – are in big trouble, with 10 per cent already degraded beyond recognition and 30 per cent in critical condition. What Apo illustrates is that it's not too late to protect these wonderfully diverse underwater ecosystems and to do so in ways that make them productive for the people who depend upon them for their livelihoods.

Coral reefs are biological wonders, among the largest and oldest living communities of plants and animals on earth, having evolved between 200 and 450 million years ago. Today, most established coral reefs are between 5,000 and 10,000 years old; many of them forming thin veneers over older, much thicker reef structures. Most of the reef colony is actually dead. Only the upper layer is covered by a thin changeable 'skin' of living coral. The tiny, transparent polyps of stony corals are the master builders of the sea, erecting their architectural masterpieces upon the remains of their predecessors. Polyps secrete calcium carbonate (the main ingredient of limestone), which they fashion into enormous homes for themselves, and in so doing, provide a rich habitat for thousands of other species.

Corals vary enormously in size, shape and colour – from the delicate filigree of the sea fan and the branching 'antlers' of the staghorn coral, to the bulging brain coral, which looks like a huge disembodied human brain. There are button corals, fire corals, lace corals, bead corals, organ-pipe corals and vase corals, all of which resemble their namesakes – over 600 species in all.

Dr Robert Ginsburg, a specialist on coral reefs working with the Rosenstiel School of Marine and Atmospheric Science at the University of Miami, compares a coral community to a self-sufficient high-rise city under the sea, where each apartment complex has its own garden. Just as the rainforest has distinct and myriad life forms in each layer of the canopy, so coral-dependent species are linked to the type of coral and its supporting cast of plants and animals.

The secret to the reef's diversity of species lies in its multi-story architecture. Reefs are like inner-city apartment blocks, where each one room flat is occupied by two organisms. Resident reef fishes which forage during the day, share their living space with other, nocturnal species. While daytime fishes are feeding, their flat is occupied by a fish or other reef dweller, say an octopus, which is only active at night. During the night, the dayshift sleeps. This sharing of quarters allows a reef to shelter two separate populations of marine organisms.

Coral reefs are tightly woven ecosystems, with incredibly complex interlinkages. Remove, or disturb one key component of the reef's fabric, and it may trigger a nasty chain reaction of events. When artisanal fishermen over-harvested parrot fish and sea urchins on reefs around the Cook Islands in the South Pacific in the mid-1980s, opportunistic algal growth soon smothered the coral, killing the polyps. Why? Parrot fish and urchins are the sanitary engineers of the reefs, cleaning the coral of excess algae. Without them, the algae proliferated out-of-control, causing the entire ecosystem to collapse. Sponges are also keystone species. They act as the lungs of the reef, cleaning and recycling the water. Remove them and a crucial ecosystem function is lost, with consequences for the entire community.

In a clear coral lagoon, north of Mombasa, Kenya, Rodney

Gary Bell/Planet Earth Pictures

Main picture: Acropora coral garden, Great Barrier Reef
Above: Hot Pink Anemones, New Zealand

Salm, a marine scientist working for the World Conservation Union, takes time out from his reef survey to explain why coral reefs are so diverse and productive. Salm, lean and tall, his skin burnished bronze from years of work in the tropics, has studied reefs for two decades.

"The high productivity of coral reefs," explains Salm, "is due to their efficient biological recycling and retention of nutrients." In a sense, they act like a very efficient production system. Instead of producing a waste product at the end of the pipe, the wastes are reused, recycled back into the coral's production process.

"What allows them to perform this remarkable feat?" asks Salm. "The coral polyps have tiny algal cells in their own tissues and these process the coral polyp's wastes before they are excreted, thereby retaining valuable nutrients." This is one reason, continues Salm, that coral communities can expand and rebuild their cities: with nothing wasted, the polyps can concentrate on growth and repair.

Nothing else in the sea rivals their biodiversity. The reefs surrounding the South Pacific island of Palau, for instance, nurture nine species of seagrass, more than 300 species of coral and 2,000 varieties of fish. Reefs provide habitat for over one million species of plants and animals.

"But putting yields aside," notes Salm, "the fundamental thing to remember is that coral reefs are no-cost, self-perpetuating fish farms which produce high quality protein from essentially empty sea water."

Warnings of destruction

Not surprisingly, reefs are the main source of animal protein for over one billion poor people in Asia, a fact that is too often ignored by the region's governments as they struggle to develop their economies, often at the expense of common resources.

As coastlines fill up with people and pollution – in parts of tropical Asia and the Caribbean population densities already exceed 500 per square kilometre – the threats multiply as well. Not only are reefs pillaged and destroyed by fishermen using dynamite and poisons. They are damaged by fine mesh nets and boat anchors dropped carelessly on coral heads. They are excavated for use in cement production and used as road fill. They are killed off by pollutants pumped into coastal waters by irresponsible industries, smothered by eroded sediment torn off the land, and choked by untreated sewage and municipal wastes flushed into coastal waters by urban areas and tourist resorts.

Scientists estimate there are roughly 600,000 square kilometres of coral reefs scattered throughout the world's tropical and sub-tropical seas. The only thing most of them have in common is their deteriorating condition. Clive Wilkinson, a coral reef expert working at the Australian Institute of Marine Science in Townsville insists that if nothing is done in time to conserve and manage coral reefs, we may well lose 70 per cent of them within 40 years.

Although Wilkinson's dire warning has been criticized as "alarmist" by colleagues, other, more detailed studies are beginning to paint a fairly alarming picture.

Extensive studies carried out on Jamaica by Terence Hughes, a marine ecologist with James Cook University in Townsville, chartered the near complete destruction of the island's coral resources. Hughes' report, detailing reef surveys done over nearly two decades, is blunt: coral cover, he reports, has been reduced from an average of 52 per cent to just three per cent around the entire island. Hughes blames over-fishing, disease and hurricane damage as the main causes of the extinction of most of Jamaica's coral reefs.

"Rebuilding the reefs will take far longer than the two to three decades it has taken to destroy them," fumes Hughes.

Back in the Philippines, marine biologist Helen Yap has documented the near wholesale annihilation of her country's coral reefs since the 1970s. While diving in the Lingayen Gulf, on the northwest coast of Luzon in 1989, Yap experienced blast fishing first hand. "There were so many blasts from dynamite fishermen that I couldn't count them during one dive," recalls Yap, who works for the Marine Science Institute at the University of the Philippines in Metro Manila. It got so bad that Yap and her colleagues stopped diving for fear of being blasted out of the water themselves.

Of course, the Philippines isn't the only country where poor subsistence fishermen and their families resort to dynamite, poisons and other illegal and dangerous techniques to put food on the table. They are, in a real sense, pillaging their children's future so they can feed them today. But most feel they have little choice. With the collapse of near-shore fisheries from years of over-exploitation and intense, unregulated competition from greedy trawler fleets, impoverished coastal communities have been left with few options.

As commercial pressures build up, subsistence fishermen are forced into a destructive cycle of dynamite, poisons and fine mesh nets. According to Daniel Pauly, a fisheries biologist working with ICLARM in Manila, "these fishing techniques are now the most common forms used in Southeast Asia, South Asia and East Africa."

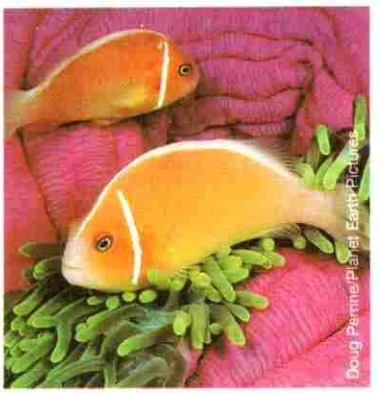
Within the past few years, cyanide fishing has taken on new and frightening proportions. Two trends are behind the alarming rise in cyanide fishing: the aquarium trade began to pay big bucks for tropical reef fish, and restaurants in Southeast Asia and China began to specialise in live reef fish.

American marine biologist Robert Johannes and New Zealand fisheries economist Michael Riepen spent two years studying the causes and consequences of cyanide fishing in Asia. Their joint report, released in 1995, claims that the global epicentre for coral diversity – a huge lopsided triangle of tropical ocean stretching from the Philippines southeast through Papua New Guinea to northern Australia, then westward through the Indonesian archipelago to Borneo – is threatened with destruction.

"We've got a big environmental murder going on," insists Johannes, "and no one is doing anything about it."

The poisons stun the fish, sometimes even killing them outright. Worse, since the coral polyps cannot move, they are often snuffed out. In no time, poisoned reefs turn white and lifeless.

As demand for live fish accelerates in Asia, the price for some reef fish, like groupers and humphead wrasse, has soared to $60 per pound, fuelling an epidemic of cyanide fishing. It is now so widespread that Johannes estimates the trade in live reef fish in Southeast Asia at between 20,000 and 25,000 metric tons a year, worth more than one billion dollars.



Reserves to the rescue

Back on Apo Island, Jesus Delmo is adamant about protecting the island's coral resources. "We don't allow trawlers in our waters and anyone caught poaching is turned over to the proper

authorities," he says matter of factly. He admits that he hates trawlers, calling them "the strip miners of the sea."

Since the coral sanctuary was set up, Apo's fisheries are thriving. Sitting on a wide stretch of beach fronting the coral reserve Delmo mends a fishing net while watching a group of scuba divers from Japan flop backwards into the water from their flat bottom dive boat.

"I'm a little suspicious of the Japanese," he admits. "Not long ago we caught a whole party of them trying to spear fish in our reserve. We confiscated their gear and sent them packing as a lesson."

Norbert Wu/Planet Earth Pictures

It looks as though the lesson was learned. Not one spear gun is spotted. In fact, Apo is now a must stop for most serious divers who come to the Philippines. After nearly a decade of protection, Apo's reserve is one of the few places in this part of the archipelago where fish populations are bountiful and the reefs intact.

Diving on the reserve a few days earlier, with a Philippine friend, was breath-taking. The first thing we spotted was an entire school of jack, their sleek, silver bodies undulating in syncronized unison. Below them, dozens of species of parrot fish, in lurid Day-Glo colours, grazed the reef, cleaning it of algae. Bright orange clown fish snuggled into poisonous sea anemones, swaying gently in the surge. Nearby an emperor fish defiantly defended his territory from a coral trout, while below them a moray eel, looking like some grotesque Halloween goblin, the rictus of a malevolent smile showing off deadly spike-like teeth, slithered into its den under an impressive staghorn coral. In the distance we could just make out the outline of a white-tipped reef shark cruising the coral for lunch. Deeper, on the floor, giant groupers lurked under brain corals as big as boulders.

The reef also boasts over 50 giant clams; a rarity in Southeast Asia, thanks to mindless over-exploitation. The Marine Laboratory at Silliman University is culturing giant clams in tanks and transplanting them to the reserve after they are deemed viable enough to survive predators. After the clams reach maturity, Apo Islanders will be allowed to harvest a certain number of them. It's all part of a programme to reintroduce this tasty bivalve to Philippine waters.

The demonstration value of the reserve has been enormous. "We now get delegations regularly from other islands," smiles Delmo. "They come from Cebu, Negros, Siquijor, Bohol, even Mindanao to see how our reserve works."

Delmo is proud of the island's accomplishments. "When fishermen from other islands come here to see our reserve, they often can't believe their eyes," he says. "They can hardly wait to return home and start their own reserves."

Clearly, the Apo lesson is one that more coastal communities need to learn. Even a little effective management can go a long way towards conserving reef resources and earning hard cash for local communities.

On the beautiful crescent-shaped island of Bonaire in the Dutch Antilles, the local communities declared their entire reef a marine park in the early 1980s. They took this step not to prohibit activities on the reef, but to be able to regulate and control them.

Dive shop operators were granted an operating license giving them access to prime dive spots; scuba divers and snorkellers were charged a "user fee", about $10 each, for access to the Park. Contrary to fears, the user fee system did not undermine the island's economy. Subsequent surveys revealed that the management system is well regarded by over 90 per cent of all visitors.

Main picture: Coral Reef with goldfish, Red Sea
Far left: Parrot fish, French Polynesia
Bottom: Clown fish
Above: Brain coral, Honduras

Peter Scoones/Planet Earth Pictures

The World Bank, which helped finance the original management plan, thinks the Bonaire model holds promise for other small, cash-strapped islands facing similar challenges.

"Building financial sustainability into marine conservation programmes is as important as identifying technical solutions to problems," notes Marea Hatziolos, a coastal and marine resources management specialist working in the Environment Department of the World Bank.

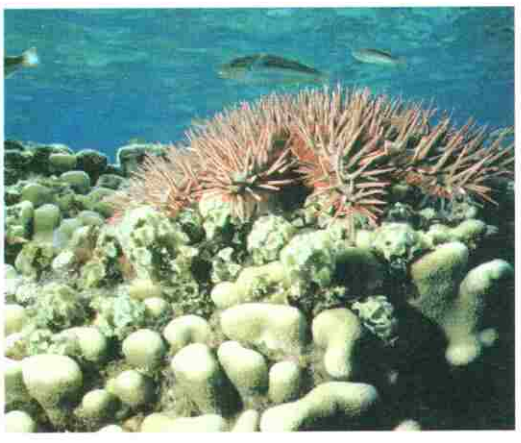
One of the keys lies in convincing people that reefs are more valuable intact than exploited. In a sense, reefs must pay their own way, in the same fashion that African wildlife in game reserves and national parks have "paid their own way" by generating jobs and tourist dollars for local communities.

This is the approach that Phuket Island took in the mid-1980s to save its coral reefs from wreck and ruination. Situated in the Andaman Sea, off the breezy west coast of Thailand, Phuket was already becoming one of the most popular holiday destinations in the entire country. What made the island special was its relative pristine nature, relaxed atmosphere and generous coral reefs.

Unfortunately, pell-mell development, without any consideration of environmental impacts, was threatening to undermine the island's tourist-based economy. Unregulated coastal development, including the construction of what one critic called "wall-to-wall tourist resorts", was sending tons of sediment into the island's clear coralline waters, where it was literally smothering the coral.

But with the sediment came another, more terrifying menace: in a number of reefs, the ugly and vilified crown-of-thorns starfish had taken up residence. Divers hate them, not only because they devour reefs, but anyone unfortunate enough to touch one with bare skin is given a painful reminder of just how nasty this creature is: its 'thorns' are laced with poison. It certainly looks the part of the evil invader from another world. The blob-like crown-of-thorns eats reefs by extruding its stomach through its mouth; it then injects a strong fluid into the coral homes of the polyps which literally dissolves them in their calcium castles, finally sucking out their remains. Since this starfish can eat its own area of coral a day, a large infestation can ruin a reef in no time.

Diving off the west coast of Phuket in 1986 with a German friend, we came upon a whole mat of these disgusting starfish, slowly munching their way across a reef flat. Where they had already dined, the coral was dead. Enraged, we spent one entire afternoon cutting them off the coral with our 10-inch-long diving knives, tossing their remains on the beach for all to see. Even in death, these creatures were foul; they rotted on the beach for days. Not one scavenger, not even the gulls, would go near them. We finally had to scoop them up with shovels and bury them in a pit. Dead, they were still dangerous.



Crown-of-thorns starfish

Tony Rath/WWF

International action

Fortunately, about the time we were killing starfish, the island's business leaders had asked the Thai government to help them devise a coastal management system that would protect their coral reefs, while permitting a certain amount of development. The Thai government, in turn, called in the Coastal Resources Centre of the University of Rhode Island to help set up a workable management plan, one firmly grounded in the special needs of the local communities.

One of the first things the CRC team did was to hold workshops and town meetings in an effort to get all stakeholders together around a common set of issues. Next they built boat moorings to reduce anchor damage to the coral and launched information campaigns aimed at local tour operators and businessmen. Once the business community saw that solutions were not going to cost them a fortune, they got behind a common plan, one designed by the communities to minimize reef damage from sedimentation by requiring that new resorts be sited farther back from the beach and that green zones be planted to cut down on runoff.

In March 1992, a National Coral Reef Strategy for the entire country was adopted by the Thai Cabinet and $2 million appropriate for its implementation, based on the Phuket model.

Recognizing the need for clear and co-ordinated international action to manage and conserve coral reefs, the United States Department of State, in close co-operation with the US Agency for International Development (USAID), first proposed the idea of an International Coral Reef Initiative in 1994. Seven other governments joined the US as founding partners: Australia, France, Japan, Jamaica, the Philippines, Sweden and the United Kingdom.

In May 1995, 100 participants from 44 countries representing governments, NGOs, international development agencies, and the private sector, gathered in Dumaguete City, appropriately within sight of Apo Island, and launched an international action plan to save the world's coral resources.

At the core of the initiative is the belief that coastal communities with coral resources need to be intimately involved in all aspects of planning and management. Solutions, if they are to be sustainable, need to be organic; in other words they need to come from the ground up, not imposed or dictated by national governments from the top-down. The other part of the Initiative is an effort to get countries with coral reef conservation plans to make them work better by involving local communities in decisions. Ultimately, the Initiative is an attempt to prevent the duplication of efforts and to compel countries and donor agencies to pool their knowledge and resources to save coral reefs. This year, 1997, has even been declared the official 'International Year of the Reef'.

The Initiative comes none too soon. There is little doubt that the coral reef crisis is going critical. But Apo Island is proof that the people who depend on reefs for their livelihoods are probably best suited to manage them on a daily basis.

"Reefs need to be managed place by place, and while each place is different, what is the same everywhere is that the people who depend upon, and will be affected by, management must be actively engaged in all aspects of the process," observes Lynne Hale, Associate Director of the Coastal Resources Centre at the University of Rhode Island in Narragansett.

It is a position that Jesus Delmo readily endorses. "We would certainly have lost our reef and our way of life if we hadn't taken the initiative to manage and conserve our reef," confesses Delmo. "We are now thinking of extending the sanctuary to cover more of our reef," he continues. "We may adopt a system similar to the one governing the Great Barrier Reef of Australia, which divides the reef into different user zones. This way we can better control human activities and also limit diving to certain areas."

As the sun sets over the island, splashing the sky a deep purple, Delmo's youngest son runs up to him: "Daddy, they are fishing in our reserve," he shouts, clearly upset.

Delmo grabs his flashlight and jogs off towards the beach. He thinks he knows who the "they" are. As we near the sheltered little cove, the outriggers drawn up in neat formation, one small boat, its lights blazing bright, sits 30 metres out, over the reserve. It's not poachers, as his son thought, but the small research boat from the Marine Laboratory at Silliman University. Students are preparing to take a survey of the reef at night.

After exchanging a few greetings, Delmo plops down on the sand, still warm from the sun. It's been a long day and he is tired. "You know," he says gazing out towards the reef, "ten years ago, none of us knew the value of a reef, now we all do. And the children are the best policemen of all. They will be able to pick up where we left off."

In his own way, Delmo has grasped the very core of the concept of 'sustainability'. And herein lies the best prospects for conserving coral reefs: the work done now must be reinforced and continued by the next generation. The challenge will be in replicating the Apo Island experience in tens of thousands of other coastal communities. ■

Up close and personal

As an avid diver, I have witnessed the degradation of coral reef ecosystems for the past 20 years. Some sites that I first dived on in the mid-1970s in Southeast Asia, were nothing but rubble by the mid-1980s, blasted apart by the very people that depend on them for their survival – poor subsistence fishermen and their families. Why destroy their own futures?

Poverty, as India's late Prime Minister Rajiv Gandhi once said, is the greatest polluter and pillager of natural resources. Hungry, desperate people, pushed to the limits, have little choice but to over-exploit their resource base. Poverty and ignorance, as well as greed and stupidity, lie at the bottom of the world's coral crisis.

Virtually every one of my many dives has left me awed and humbled by the experience. The world of the reef is a micro cosmos of its own: a world within a world, wrapped in enigmas and mystery.

Reefs explode with life and death. Fish are eating and being eaten, breeding and nursing, foraging and hiding, fleeing and defending territory. A friend once remarked that viewing a reef up close and personal was his most intimate experience with the natural world, one that can never be equalled on land. Reefs make the Serengeti Plains of East Africa seem like a theme park. After all, he said, you cannot walk up to a lion and look into its eyes, not unless you have a death wish.

Yet, on reefs, anything is possible. Off the San Blas Islands of Panama, a three-foot long barracuda, sporting rows of razor sharp teeth, swam brazenly up to my face mask before disappearing in a blur of fins. On another dive, an over-zealous cleaning wrasse tried to clean my ear and a bright orange coral shrimp hitched a ride on my oxygen tank. I have been bumped by a white-tipped reef shark, as it fled in absolute panic, and was once stared down by an impressive-looking moray eel.

Neptune's canvas is a riot of colour and motion. Nothing on a reef is static. Yet there is a discernible order to this universe of chaos, if you take the time to see it. Fish stake out and defend territory as diligently as any bird or animal. While diving on a Jamaican reef (back in the late 1970s), aggressive, coal black angel fish were constantly biting the back of my legs, ever-present reminders that I was in their patch of coral.

One of my best dives was in Bali Barat National Park, on the north coast of Bali, Indonesia, in 1981. The reef flats cover several hectares, while the coral face drops off 100 feet straight down. Each level had its own peculiar residents, its own offerings — like an apartment store. I watched lumbering coral trout visit the local equivalent of a dentist: a cobalt blue cleaning wrasse. The trout, 100 times the size of the tiny wrasse, opened its mouth and gills to let the wrasse clean away food debris and parasites. Nearby, sunset orange clown fish nestled into sea anemones, the only fish immune to its venomous tentacles. Below, a sea snake, one of the most poisonous, slithered away, more alarmed than curious.

Suddenly I am surrounded by fish, dozens of species. A bright yellow tang, the colour of sunflower, swims right up to my face mask and peers in, followed by a carmine-coloured parrot fish, a butterfly fish, several surgeonfish and a harlequin tuskfish, banded like a rainbow, brilliant red-orange. Then a very large grouper moves ponderously through the throng, stopping long enough to give me the once over before moving on. In the distance a column of cornetfish, hanging vertically in the water, look like exclamation points. They don't even sway with the surge of the surf as it pushes you into the coral, then pulls you away.

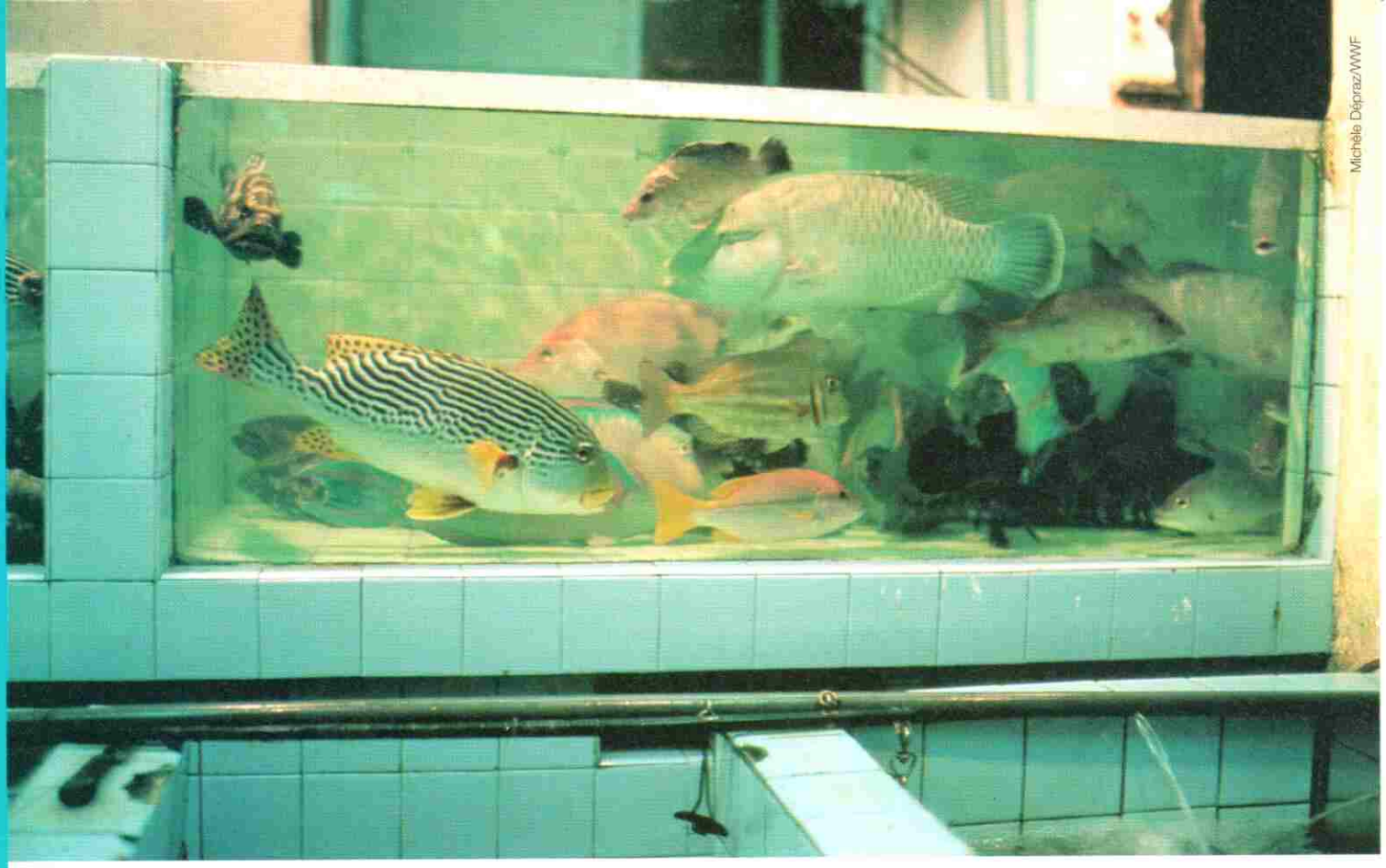
Reefs have their own logic, something marine biologists are constantly trying to figure out. For me, it is privilege enough to be allowed entrance to this parallel universe, no matter how short the time.

One incident stands out. I was diving in the lower Gulf of Thailand, off the east coast of Kota Baharu, Malaysia. While slowly snorkelling back to shore, after a long dive, I was pushing a large yellow float containing tanks and other gear beside me. Casually, I look under the yellow float and am astonished to see a tiny canary yellow fish, not more than six inches away from my face mask, keeping perfect pace with the float. It looks at me and I look at it. It shows no fear and swims along, always staying under the yellow float.

As I near shore, and another patch of coral, the little fish dives for the bottom, disappearing into a row of sea fans. It was then that I noticed an emperor fish, one of the most efficient predators on the reef, following behind. Could it be that this little fish was using me for cover while traversing an open stretch of water? Was there an intelligence at work here, or only raw instinct? I will probably never know. But like all my reef experiences, that incident has left me with another image I will never forget. ■

Don Hinrichsen

Norbert Wu/Still Pictures



Michèle Dépraz/WWF

What price a re

Robert Ginsburg from the University of Miami is one of the moving spirits behind the International Year of the Reef. Here he joins with his colleague **William Kiene** to outline what the Year hopes to achieve.

What is the price of a reef-fish dinner? Hong Kong's South China Morning Post recently reported that a local restaurant paid $10,256 for a large fish from an Indonesian coral reef. With these lucrative returns, it is no wonder poor fishermen will risk their own lives to catch these increasingly rare fish. But the highest price may be the threat posed to the health of coral reefs that sustain their livelihood.

From Southeast Asia to South Florida, coral reefs show signs of decline, not only from destructive fishing methods, but from a multitude of injuries inflicted by growing populations. In response, 1997 has been declared the International Year of the Reef. This global campaign is being organized to assess reef condition around the world, document the causes of reef decline, and educate the public in order to preserve these remarkable ecosystems and their rich resources.

The International Year of the Reef (IYOR) is a coalition of scientists, environmentalists, sport divers and students who want to highlight the importance of reefs and promote conservation and sustainable use of reef resources. It is the public counterpart of the International Coral Reef Initiative, a multi-government-sponsored initiative aimed at the promotion of sustainable management of coral reefs and their associated sea grass beds and mangrove forests.

Both programmes emphasize the growing concern for the survival of reefs and underline the increasing recognition that reefs are essential to the economic health of many nations of the world.

The impetus for IYOR came in 1993 at a meeting of more than a hundred reef scientists who enumerated the threats to reefs, but concluded that data on the global extent of declines and impacts was inadequate. Accordingly, during IYOR, reef scientists will make an extensive diagnosis of reef health around the world. They will explore reefs never before visited by scientists. And they will re-survey reefs studied decades earlier to gauge long-term impacts of both natural and anthropogenic stresses.

These assessments by specialists will be supplemented by Reef Check 1997, surveys of reef corals and fishes worldwide by volunteers from at least 70 sport diving groups. Together, these complementary programmes will provide the first-ever comprehensive overview of global reef condition.

Just as diagnosis is the first step in treatment, the problems of the coral reef crisis need to be identified before remedies can be prescribed. But there is no universal cure for reef degradation. Reef illnesses are as varied as the reefs themselves.

Overfishing for subsistence and

livelihood is a principal disorder on reefs in many island nations where socio-economic alternatives are in short supply. An infusion of restorative measures developed in partnership with these nations may help. Alternatives may include the recognition that live fish have more long-term value as tourist attractions than as a short-term food supply. Establishing no-take fish reserves that are monitored by local populations can maintain stocks. Aquaculture of corals and tropical fish could reduce pressure on wild stocks. Convincing diners that large reef fish are more valuable as key elements in the reef ecosystem than as status-symbol meals could reduce current run-away harvesting of these majestic and essential elements of reef ecosystems.

Coastal runoff of sediments and fertiliser is a significant threat to reefs that prefer, clear, low-nutrient water. Proper design of land development and forest logging in Central America, the Philippines and Indonesia can reduce the deterioration of coastal water quality. Halting the discharge of industrial pollutants and untreated sewage from centres of population can heal chronic affliction on near-shore reefs throughout the tropical world.

Increasing public awareness of coral reefs through education is a major goal of IYOR. A variety of activities are being planned in at least 30 countries: regional work-shops on reefs and reef management will be held in Kenya, Brazil and Fiji; teaching aids on reefs for students and the public are being developed in Mexico, Columbia and the United States; television documentaries and public service announcements are in production in several countries. Special programmes on reefs are planned for zoos and public aquaria; a poster contest for students is in the works; lectures and demonstrations about reefs are scheduled in Germany, the Philippines and the United Kingdom; field trips for families and a reef awareness weekend are being planned in Florida; and formal galas to inaugurate IYOR will be held in London, Dusseldorf, Miami and elsewhere.

These numerous initiatives are just the beginning, and interest groups all over the world are being encouraged to develop their own events.

Coral reefs are one of earth's natural treasures. We, the users and beneficiaries of their remarkable resources must do all that we can to preserve them in good health for future generations. IYOR can play a key role in this crusade. It deserves widespread support. ■

Robert Ginsburg is Professor of Marine Geology at the University of Miami's Rosenstiel School of Marine and Atmospheric Science and Chairperson of the IYOR Organizing Committee. William Kiene is a member of the Organizing Committee who studies reefs in both the Atlantic and Pacific Oceans.

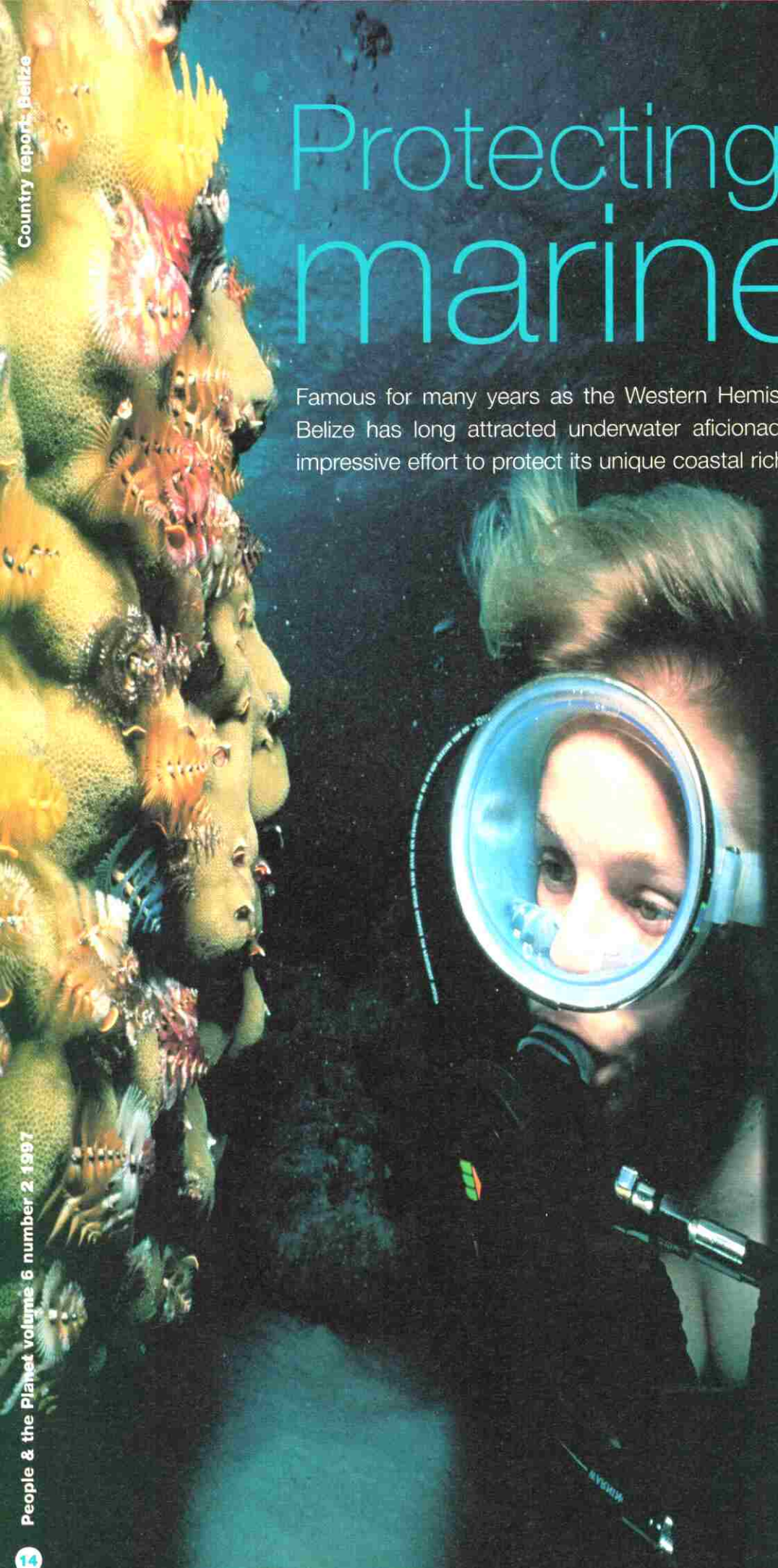
ef-fish dinner?

Roland Seitre/Still Pictures

Left: Tropical fish for sale in Hong Kong
Below: Crawfish fishing, Robinson Crusoe Island, South America

Protecting a marine wo

Famous for many years as the Western Hemisphere's largest barrier reef, Belize has long attracted underwater aficionados. It is now mounting an impressive effort to protect its unique coastal riches, as **Sue Wells** reports.



Perhaps the best way to get an impression of Belize's unique reef system is to take one of the little planes that ferry passengers along the coast between Belize City and Punta Gorda, a sleepy little town near the country's southern border with Guatemala. Laid out below, on a clear day are all the main types of coral reef – something few countries in the world can match.

In the distance, to the east, lie two of Belize's three atolls, Turneffe and Glovers Reef, with Lighthouse lying further seaward out of sight. These large ring-shaped, island-topped reefs are more typical of the Pacific and Indian Oceans than of the Caribbean. Closer to shore, and marking the edge of the continental shelf, are the segmented ribbons of the barrier reef itself, edged with white breakers. Nearly 260 km long, this runs from the northern border of the country with Mexico, where it is only about 1 km offshore, south to the Sapodilla Cayes which lie some 40 kms offshore. The barrier reef plays a vital role in protecting the low-lying coast from storms and hurricanes.

The third main type of reef, fringing reefs, can be seen at a few spots immediately off shore in the south, although the protected inshore waters of Belize tend to be silty with muddy bottoms, restricting the growth of corals. Within the sheltered lagoon waters of the barrier reef, particularly in the south, lie a network of other reefs, including unusual diagonal-shaped structures called 'faroes'.

The observant passenger can learn a number of other important facts related to Belize's reef system from this short flight. To those used to the crowded shores of Asia, Europe and north America, Belize's coastline appears remarkably empty, a reflection of its small human population of only about 200,000. But a glance to the rugged Maya Mountains in the west will show that most development is taking place in coastal areas, where nearly 40 per cent of the population live. With half of its territory lying under the sea, the country's economy is dependent, either directly or

Yves Lefevre/Still Pictures

Left: Underwater diver
Below right: Conch harvested on Sapodilla Cayes

nderland

indirectly, on its coastal and marine resources, and in particular on its reefs.

Since early this century, the economic role of Belize's reefs has increased steadily. Initially, their importance lay in the fishing industry, with a wide range of species being harvested including turtles, sharks, finfish, sponges and seaweeds. Today, lobster and conch contribute most of the total value of exported wild-caught seafood, estimated at over US$10 million in 1995. Much of this is still harvested with traditional wooden sailing boats, or dories, and dug-out canoes. Reef fish, particularly grouper and snapper, are also taken. Belize is lucky in that it has not, as yet, suffered the serious overfishing experienced in other countries, but catches of several species are declining, illegal fishing of under-sized conch and lobster is frequent, and there are fears that over-exploitation is now occurring.

The main use of the Belize Barrier Reef is currently tourism. This is the country's largest source of foreign exchange and generated an estimated US$75 million in 1994, when tourists totalled nearly 90,000. The reefs and their associated islands, known as 'cayes' of which there are over 1,000, are major attractions: most of the hotels are in the coastal zone and about 80 per cent of tourists go snorkelling and diving. Indeed, passengers on the local planes invariably include tourists, bound for San Pedro, Dangriga and Placencia, which are popular departure points for the small resorts that dot the reef.

This in turn is creating a new set of pressures. Boat traffic on and around the reef has increased dramatically with the growth of tourism and sport fishing and the introduction of fast power boats to take people out to the cayes. Scarring by boat propellers can be seen from the air in many of the shallow areas behind the barrier reef. The most popular dive site, Hol Chan Marine Reserve, receives over 30,000 visitors a year, and there is concern about the impact these may have on fragile corals. Jetties, sea walls and manicured beach fronts are springing up on the cayes, altering the natural ecology of these vulnerable ecosystems.

A flight along the coast is also the best way to see the impact that activities inland can have on marine waters. This is particularly obvious after heavy rains, when the rivers draining the mountains turn chocolate brown and large silt plumes extend out towards, and occasionally beyond, the barrier reef, carrying logs and branches as evidence of their forest origin. The rivers also carry a range of pollutants, notably agrochemicals from citrus and banana plantations.

Despite the small population, sewage pollution from treatment facilities, septic tanks and direct outfalls is also a potential threat, particularly around the mouth of the Belize River, Belize City, Dangriga and the developed cayes. Belize City is the only coastal town with a centralized sewerage system, with one shortly to be opened in San Pedro, but both provide secondary treatment only.

Protected areas

The earliest attempts to protect Belize's reefs focused on the establishment of protected areas. Half Moon Caye Natural Monument, on Lighthouse Reef, was set up in 1982, followed by Hol Chan Marine Reserve in 1987, the latter designated as a result of an initiative taken by the community of San Pedro who saw that some form of management would be necessary to reconcile the conflict developing between fishermen and tourist operators, both dependent on the reef for their livelihoods.

Belize now has a remarkably ambitious marine protected area programme given the size of the country, with a further six sites designated recently (South Water Caye Marine Reserve, Sapodilla Cayes Marine Reserve, Bacalar Chico National Park and Marine Reserve, Glovers Reef Marine Reserve, Blue Hole Natural Monument and Laughing Bird Caye National Park). Other protected areas are being planned for Caye Caulker, the Port Honduras area in the south of the country, and for parts of Turneffe Atoll.

All these sites have, or will have, zoning schemes providing for recreational activities, small-scale fishing by traditional users, and total protection of key habitats and species in 'no-fishing' zones. The 'no-fishing' zones cover a small area at present but potentially could play an important role in managing the reef fisheries, by protecting breeding stocks that may eventually repopulate other depleted areas. The no-fishing zone at Hol Chan Marine Reserve, with its enormous groupers and shoals of snapper, illustrates how effective this can be.

Coastal management

Initially the Great Barrier Reef Marine Park in Australia was viewed as a model for coral reef management in Belize. However, largely through the foresight of Janet Gibson, who has been involved with the protection and management of Belize's reefs for many years, it was agreed that an integrated coastal zone management approach would be more appropriate, taking account of the land-based activities causing siltation and pollution. A Coastal Zone Management Unit was established in 1990 within the Fisheries Department, and a more permanent coastal zone management (CZM) programme is now being set up, assisted by the United Nations Development Programme (UNDP) and funded by the Global Environmental Facility (GEF).

Two committees are responsible for integrating management efforts in the coastal zone. The CZM Technical Committee was established in 1990 to facilitate working relationships between all the agencies involved. It comprises representatives of government departments, community and private organizations, education and research institutions and NGOs involved in coastal zone management issues. It encourages the sharing of information, contributes to the creation of feasible government policies, plans and programmes, identifies technical problems, and provides advice on a variety of issues including projects that may

Sue Wells

require Environmental Impact Assessments.

A Steering Committee, established in 1993 and comprising representatives at a more senior level of the relevant agencies, oversees implementation of the programme and ensures inter-ministerial co-ordination. Considerable emphasis is being placed on land-use planning, as it is clear that the careful location and design of industry, agriculture and urban developments can do much to minimise adverse effects on coastal waters and thus on the reefs.

Plans for a more permanent institutional arrangement have been drawn up and approved by Cabinet. The Steering Committee will evolve into a CZM Authority, which will have a co-ordinating and advisory role, statutory responsibilities remaining with the relevant Ministries. In addition a CZM Institute will be established, affiliated with University College of Belize (UCB). This will play an important role in monitoring, research, education and training and provide a supporting role to relevant government departments. A Coastal Zone Management Act is being drafted to establish these bodies.

Tony Rath/WWF

Above: Cay coral island, Belize
Below: Lobster fisherman, Belize

Involving stakeholders

Considerable emphasis has been placed on the involvement of local communities throughout the development of this programme. This is often achieved by establishing committees. For example, each land use planning area has a local committee, with representation from all sectors of the community. This is consulted during the preparation of the plan, and once implemented should review development applications from the general public and implement and manage the plan (at present, few plans have reached the implementation stage). The designation of protected areas in the coastal zone also involves extensive consultation and the holding of public forums, a process that will be made obligatory through new legislation. Advisory Committees are set up for each protected area, comprising representatives of all the main stakeholder groups and of the agencies and NGOs responsible for management.

Public participation is also taking place in more direct ways. Fishermen are taking part in monitoring and assessment programmes of the main commercial fisheries stocks. Dive operators play a major role in the installation and maintenance of mooring buoys, which prevent damage to corals from anchors, and will be taking part in a National Mooring Buoy programme being set up by the Fisheries Department. Workshops and courses have been held and are being planned for both dive operators and tourists to encourage environmentally conscious diving and snorkelling. All tour guides belong to local associations and these provide a good basis for improving management of reef tourism.

Future plans

The long standing efforts of this tiny country to manage one of the marine wonders of the world were finally given international recognition in December 1996 when seven of the protected areas on the reef were listed jointly as a World Heritage Site under UNESCO's World Heritage Convention. However, there is a long way to go to ensure that the reefs maintain their health.

Belize's determination to become self-sufficient, and no longer dependent on external assistance to manage its marine resources, may prove crucial to its success. To achieve such self-sufficiency there are several essential requirements: financial sustainability, sufficient national capacity for management, and the political will and public support that will permit such management to be undertaken.

Like many countries, the government of Belize is facing increasing economic constraints, and a variety of revenue generation strategies will be necessary for an effective Coastal Zone Management programme. The CZM Act will therefore allow for the introduction of resource user fees, such as a diving and snorkelling fee which could be levied from all tourists. The establishment of Trust Funds for individual protected areas will also be encouraged. Such a fund is in place for Hol Chan Marine Reserve and already covers its basic running costs, revenue coming from entrance fees (US$2.50 for overseas visitors, half that for nationals).

Belize's small population is a severe constraint to producing the number of trained personnel needed for the coastal programme. This problem is being tackled though close collaboration with the University College of Belize. A new marine science programme is to be developed, and the CZM programme has supported the first nationally owned and managed research and education centre based on the reef, UCB's Marine Research Centre on Turneffe Atoll.

Close collaboration is also being developed with the two US-owned laboratories, the Smithsonian Institution's Carrie Bow Caye laboratory, and Glovers Reef Marine Station which is run by the Wildlife Conservation Society.

A rapidly growing number of Belizeans are now receiving training in marine resource management and are learning of the importance of reefs to their country. School children visit the Marine Research Centre, students from UCB who help out on research programmes, and numerous young Belizeans are learning to dive with programmes such as Coral Cay Conservation and Raleigh International, two UK-based organizations that bring volunteers to the country to carry out basic survey and research work on the reefs and help develop local capacity for such activities.

These activities, combined with the innovative environmental education and public awareness programmes run by NGOs such as the Belize Audubon Society and the Belize Center for Environmental Studies, are helping to generate a solid constituency for reef protection and management within the country. It is an approach that other countries may find a useful model. ■

Sue Wells is Head of the Marine Programme at WWF International, Gland, Switzerland.

Jonathon Ridley/Coral Cay Conservation Ltd

Extending for more than 2,200 kilometres along the north-east coast of Australia, the Great Barrier Reef is the largest coral reef complex in the world. Here **Graeme Kelleher**, former Head of the Great Barrier Reef Marine Park, considers the past and future of this treasure of the sea.

Norbert Wu/Still Pictures

Australian treasure

With more than 2,900 individual reefs varying in size from less than a hectare to more than 100 square kilometres, the Great Barrier Reef like other coral reefs, is a wonderfully diverse ecosystem. The Reef is inhabited by more than 400 species of coral, 1,500 species of fish, 4,000 of molluscs and 260 species of birds.

While the numbers are impressive, the ecological complexity of the reef ecosystem is greater even than those numbers suggest. Charles Darwin, in his famous book *The Origin of Species* expressed this complexity as follows: "How complex and unexpected are the checks and relations between organic beings, which have to struggle together in the same country."

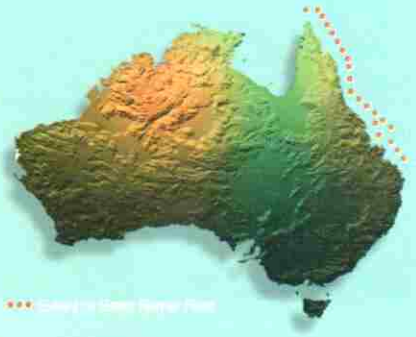
This struggle has been called 'nature, red of tooth and claw' Anyone who snorkels or scuba dives on a reef for even a short time will see animals eating each other. What is less obvious is the co-operation which occurs between different animals and plants, called symbiosis. The most famous example of this is the co-operation between the symbiotic algae which live in the tissues of reef-building corals and, by capturing the energy from sunlight, magnify many times the ability of the corals to build their calcium carbonate homes. In return, the corals provide protection for the algae from fish that might eat them.

More obvious are the brightly coloured cleaner wrasse which establish cleaning stations to which reef fish come when they wish to be cleaned of parasites. The cleaner wrasse benefits because the parasites are their food, which is brought to them virtually on a plate. Typically of nature, false cleaner wrasse have evolved. These fish are the marine equivalent of confidence tricksters. Posing as cleaner wrasse, they bite a hunk out of unwary fish hoping to be cleaned.

The Reef is full of examples like this.

Protecting the reef

Australians have always been proud of the Reef a feeling which resulted in widespread public indignation in the early 1970's when the Queensland Government proposed to mine the Reef for lime for cement and to allow oil drilling. Led by a few highly committed people – scientists, conservationists,



Yves Lefevre/Still Pictures

writers and poets – Australians came together to ensure that the Reef would be protected.

The first step in this long process was the passage in 1975 of the Great Barrier Reef Marine Park Act by the Federal Parliament of Australia, with the support of all political parties. This Act established a small Authority of three people, one of whom was to be nominated by the state government. The recent addition of a fourth member ensures that the interests of Aboriginals and Torres Strait Islanders will be directly represented in the Authority.

A Consultative Committee was also established, representing groups with major interests in the Reef. The legislation defined the Great Barrier Reef Region which covers an area of more than 350,000 square kilometres – larger than the United Kingdom but, unfortunately for publicity purposes, smaller than Texas.

The Act gave the government the power to create a marine park within that Region. Most people at the time foresaw a marine park that would occupy only a minor proportion of that immense Region. Through the efforts of many people, 98.4 per cent of the entire area is now a marine park – by far the world's largest marine protected area.

The essence of the marine park is zoning, defining what people can do in each zone. There are three basic kinds of zones:

- General use zones (nearly 76 per cent of the park area) – which allow most non-destructive activities to continue. In one of these zones, bottom trawling is prohibited.
- Marine national park zones (23.1 per cent) – which allow activities similar to those permitted in national parks on land. Commercial fishing is not permitted in any of these zones.
- Preservation and scientific research zones (1.1 per cent) – in which only approved scientific research can occur.

The basis for the relative success of the marine park has been participation. While the Act provides for such participation, the Authority has deliberately gone far beyond the requirements of the Act to ensure that everybody's interests and opinions are taken into consideration in zoning, management and research. This process led to the production in 1994 of a Strategic Plan for the Great Barrier Reef World Heritage Area, which encompasses all of the Great Barrier Reef Region including its 1,000 islands.

Pete Atkinson/Planet Earth Pictures

The plan brought together 60 organizations to express a 25-year Vision for the Reef and to agree on five-year objectives necessary to obtain that vision. All of the 60 participants, which included government departments, industry groups, research institutions and voluntary conservation organisations, committed themselves to these objectives.

Biggest danger

As in the rest of the world's seas, the major threats to this wonderful creation come from human activities. These are pollution, over-fishing, destruction of habitat and introduction of exotic species. Climate change is not mentioned because increased global temperatures which may cause sea levels to rise are likely to increase the extent of the Reef and convert the vast algal flats to living coral, although there may be an increase in coral bleaching and mortality in some parts of the Reef.

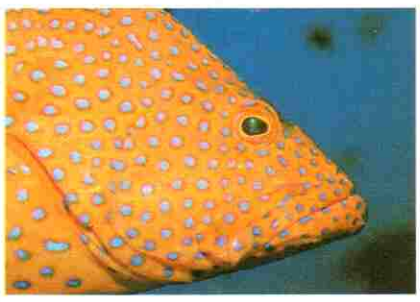
I believe that pollution is the biggest danger. There is scientific evidence that the runoff from the mainland of nutrients and suspended sediments has increased fourfold since Europeans first came to Australia. Nutrients allow algae to out-compete corals and may increase the frequency and severity of outbreaks of crown-of-thorns starfish. These starfish, when mature, eat living coral. In the last major infestation, six per cent of the individual reefs that make up the Great Barrier Reef were severely affected.

Suspended sediments inhibit the sun's energy from being used for reef building.

Bottom trawling removes all living things from the seabed and grossly changes habitat, with ecological consequences that are not yet really known.

The Authority's approach to all of these threats has been the same. Scientific research is carried out to determine the extent of the threats and to identify methods of combating them. The community group or industry whose activities are believed to create the threat are deliberately involved in the research programme and in developing solutions. Common interests with these groups are identified so that co-operation can be achieved, rather than conflict. Most importantly, there is a strong emphasis on public education and communication so that the Australians are aware of the threats and the things that are being done to combat them.

One example is the work with farmers. Most of the nutrients and suspended sediments come from farms on the mainland, and farmers are no more in favour of losing their topsoil and of having their expensive fertiliser end up in the sea than are people who are concerned about the welfare of the Reef. This realisation and its communication


Norbert Wu/Still Pictures

throughout the community has led to co-operation between farming organizations and those responsible for managing the Reef. Integrated research programmes have investigated the problems and suggested answers. Loss of nutrients from sugar cane farms on the adjacent mainland have been reduced ten-fold by ploughing the stubble after harvesting into the soil, rather than burning it.

The fishing community is just as interested in ensuring that there will be fish to catch in the future as are the conservationists. Strongly collaborative research and management programmes have been established as a result. A major experiment is measuring the ecological effects of fishing. If that research indicates that fishing practices should be changed to protect the Reef, the Authority has the power to ensure that those changes occur, for example, by increasing the areas in which fishing is prohibited.

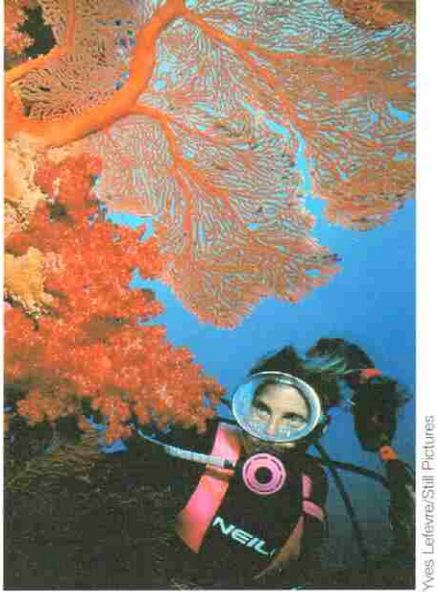
Uncontrolled tourism is the focus of many people's concern. Personally, I believe that tourism is the easiest of human activities to control and consequently not the dominant threat. Every tourist operator on the Reef is required to have a permit from the Authority, which defines where he or she may operate and details the controls which apply. If those rules are not followed, the permit may be revoked or civil or criminal charges may, be laid, with large potential penalties.

Typical of the Authority's approach, every operator is required to carry out a public education programme and is held responsible for the conduct of the customer. Unlike on land, a visitor to the Reef does not need to leave even a footprint.

Ten-year test

This great treasure of the sea is not immune to the threats which pervade all of the world's seas. However, the approach to management exemplifies all of the methods now seen as vital to achieving sustainability, including integrated ecosystem management, scientific research, public participation and education.

There have been many successes – for instance, all of the tourism developments on the Reef are required to treat their sewage to tertiary standards (removing the nutrients). However, the conflict between the desire to maximize profit from the Reef and the need to protect it will continue. The next ten years will see whether there is sufficient commitment in the hearts and minds of Australians to preserve this unique environment from insidious degradation. ■



Yves Lefevre/Still Pictures

Graeme Kelleher was for 16 years Chair and Chief Executive of the Great Barrier Reef Marine Park Authority. Since 1986 he has been Vice-Chair (Marine) of the IUCN's World Commission on Protected Areas, co-ordinating efforts to establish a global, representation system of marine protected areas.

Top left: Coral isles along the reef
Middle left: Giant clam
Bottom left: Coral trout: changes colour at will
Above: Diver and coral, Australia

Secret sunscreen

These days basking on the beach comes complete with a deadly health warning of skin cancer. Now, however, Australian scientists believe that a valuable weapon against the disease has also been on the beach all along, washed up onto the sand. They have discovered that a solution to warding off the sun's rays can be found in coral.

Such a discovery would be of special importance to Australia which has the highest rate of skin cancer in the world. Two out of three Australians can expect to get some form of skin cancer at some point in their lives.

Now, the Great Barrier Reef could unlock a new way of protecting people against skin cancer because the coral on the reef flourishes despite being exposed to intense ultra violet light. The Reef is a natural living structure and coral itself is half plant and half animal. Unlike other animals it has no hair, feathers or scales to protect it from the damaging effects of ultra violet light.

The mystery of how it survives has fascinated scientists from the Australian Institute of Marine Science. Heading the team is Dr Walt Dunlap. He believes that the corals must have built up some sort of protection: "corals have a natural defence mechanism which would be a biochemical means of adapting to the very high light intensities." To find out what form this protection takes, Dr Dunlap analysed samples of corals from the reef.

Taking samples of corals from different depths has been the vital key in unlocking the secret of the coral's protection. As they get closer to the surface and nearer to the sun one compound, in particular, becomes more and more apparent.

In the laboratory, the coral is crushed into small pieces which are then soaked in alcohol to draw out its natural chemicals. The solution is then put in a spectrophotometer which scans the extract with high intensity light. This machine looks for compounds that absorb damaging ultra violet rays, and, if the coral has a built-in sunscreen it will show up as a peak on the graph.

Through his research, Dr Dunlap has discovered that coral contains a natural sunscreen, an unusual type of amino acid. This chemical has now been copied in the laboratory. That means that the scientists can make a sunscreen we can all use but leave the reef undamaged. If human trials of the sunscreen are successful, it will reach chemist shelves in the next few years.

But is doesn't just end with coral sunscreen in a bottle. Some fish which eat coral can store the natural sunscreen in their skins. And although fish and people are different, scientists are hoping, through more research, to develop a sunscreen pill for humans in the near future.

This article was extracted from the BBC science programme Tomorrow's World.

Mark Edwards/Still Pictures

Andy Crump/Still Pictures

Left: Mined coral destined for lime kilns

Below left: Coral rubble from blasting

Below: Coral mining using mechanical diggers

Right: Local woman prepares coral for a kiln.

Illegal and live coral no longer feed these kilns

Sri Lanka is a global leader in coastal management and a nation where 'holding the line' against erosion of the shoreline is a national priority. Here **Lynne Zeitlin Hale** reports on a hard-won success story.

Putting an end to coral mining

Because coral reefs play an essential role in buffering the erosive forces of waves, their protection in seven locations along Sri Lanka's exposed southern coast, where they are concentrated, is high on the national agenda. But turning this priority into reality has been an enormous challenge to Sri Lanka's Coast Conservation Department (CCD).

Coral mining, which has occurred in parts of Sri Lanka for over 400 years, has been a major problem for this national coast management agency since its inception in 1978. Coral is the principal source of lime for Sri Lanka's construction industry, supplying approximately 90 per cent of the lime used. Up until the 1960s, when a building boom started in Sri Lanka, only fossil reefs located inland from the shore were mined. But as the demand for the easily worked coral lime increased, so did coral mining. Residents in a number of locations along the south coast began collecting coral rubble from the beach; and as demand further increased, people began going out to the living reef, with crowbars, and breaking off pieces of coral to sell to lime kiln operators. Such activities not only destroy reef habitat, but also reduce the protection from erosion offered by the reef.

Alan White

Since it became a Department in 1981, CCD has attempted to halt coral mining in the coastal zone. At first it relied exclusively on framing and adopting policies and regulations that made coral mining within the coastal zone illegal; yet the problem remained a significant one. In 1984, over 18,000 tonnes of coral lime were mined, 58 per cent of it illegally from the coastal zone.

The socio-economics of the industry compounded the problem. About 1,200 individuals were directly engaged in this activity. In just four months, coral miners were able to earn over $300, about the same as the then average annual income in Sri Lanka. At the same time, the problem was undermining the credibility of CCD, which on other fronts was making outstanding progress on improved coastal management.

Eventual success in halting coral mining has been difficult. The Department learned the hard way that they had to work on many fronts. In 1988, it obtained a specific legislative amendment to its enabling legislation which made coral mining, collecting, processing, storing, burning and transporting in the coastal zone illegal. While this stronger legal mandate was necessary, it was not enough. Coral mining remained a very visible problem, causing CCD problems both at home and with some of donors that were supporting their erosion management activities.

Multiple strategies were clearly needed; and some worked better than others. CCD identified and found funding for alternative livelihood schemes for coral miners. Sometimes this had unanticipated consequences – like attracting people to become miners so they could become eligible for a particular alternative livelihood scheme. Alongside this, it carried out research to identify alternative sources of lime, but so far these sources have not been developed.

Andy Crump/Still Pictures

CCD also carried out education programmes, with miners as well as with police officers who had to enforce the law, and with the communities where the law was enforced. As the education efforts began to take effect, and create more awareness of the problem and its consequences, CCD was able to step up its enforcement actions and demolish illegal kilns in the Aluthgama/Matara section of the coast.

These sustained efforts are paying

Alan White

off. By the early 1990s, the problem was contained and coral mining was no longer spreading to new areas. By 1993 the amount of "illegal" coral being mined was reduced significantly, down to about 4,000 tonnes per annum – a 48 per cent decrease from 1984.

In two areas along the southern coast – Hikkaduwa and Rekawa – CCD was able to achieve even greater compliance with the coral mining prohibition. For the last two years, Special Area Management (SAM) planning efforts have been underway at both sites. Through the SAM process, CCD, in partnership with the communities and other government agencies (both local and national) has developed plans that move people towards sustainable coastal resource use – including the sustainable use of coral reefs. In both locations, coral mining has been reduced by about 95 per cent; and in Rekawa, over 75 illegal coral lime kilns have been voluntarily demolished. The remaining coral lime production is now using coral debris from demolished buildings and inland fossil coral.

While Sri Lanka has not yet totally solved the coral mining problem, solutions are in sight. What has it taken? It has involved multiple strategies: sufficient legal authority, political support at both high and local levels, a partnership between resource users and resource managers, identification of alternative sources of lime, and perhaps most important of all, CCD's creativity, patience and perseverance. ■

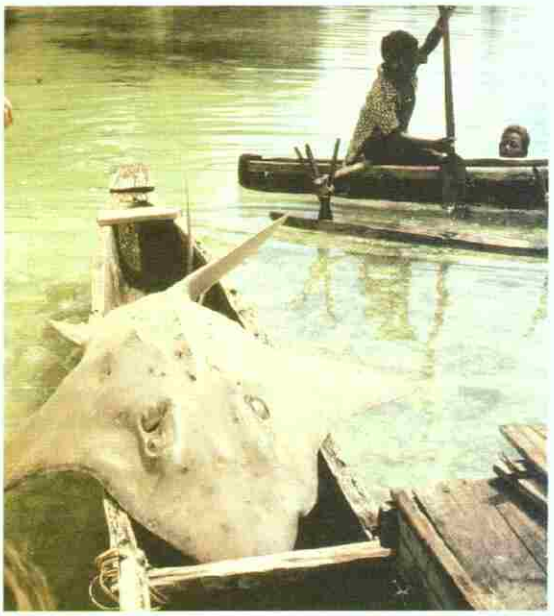
Lynne Zeitlin Hale is the Associate Director of the University of Rhode Island Coastal Resources Center, which has been working with the Sri Lanka Coast Conservation Department (CCD) since 1985. She would like to acknowledge the CCD Director Nissanka Perera's assistance in reviewing this article and making CCD surveys, reports and other date available.

Pacific Island reef taboos

Coral reef systems and the resources they support are critical to the lifestyle and economies of South Pacific peoples, *writes Paul Holthus*. Pacific islands contain an immense amount of coral reef habitat, with some entire countries consisting of atolls and/or raised reef islands, made up of a diverse array of reef types which support high levels of biological diversity.

In many Pacific islands, coral reef resources were the principle supply of animal protein and island dwellers have long been aware of the limits to these resources. As a result, Pacific Islanders have practised most basic forms of marine resource conservation including: closed seasons and areas, size and gear restrictions, and, most importantly, customary marine tenure and limited entry rights.

Traditional fishing rights equipped Pacific island fishers with control over access to reef areas, providing a mechanism and incentive for the sustainable use of their reef resources. Unfortunately, these rights have been eroded or lost in many areas over the past century, largely due to their incompatibility with outside concepts of open access to marine resources.



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Ironically, it is now recognised that the most effective management of many marine resource systems is through some level of ownership by resource users. This is especially true for coral reefs with their complex multi-species fisheries. Increasing efforts are being made to strengthen and revive traditional reef management practices and integrate them into the contemporary situation as the basis for sustainable use.

Paul Holthus is Marine and Coastal Programme Officer at the World Conservation Union, Gland, Switzerland.

Ken Kiang

Faced with growing destruction of their coral reefs, more and more communities in the Philippine islands are joining the battle to manage and conserve their coasts. **Linda Bolido** and **Alan White** report.

Reclaiming the islan

Luís de la Concepción III tried to get out of the family "business".

The son of fisher folk, he moved out of his small village in the central Philippines province of Negros Occidental to try his luck in Manila, the country's capital. After finding life just as tough in the big city, De la Concepción is now back in Caliling where local legend says giants roamed in the past.

He has taken up fishing once again but often still finds himself with very little to show for his efforts. Using simple tools like multiple hooks and lines and nets and sharing his catch with the owner of the boat, the fisherman on a good day gets a little less than $2 and on a bad day less than 50 cents. Harsh weather means not going out to the sea.

Things have not always been that bad for the local fishermen. But the unwise exploitation of marine resources over the years has taken its toll. Ham Chua, President of Calaogao Marginal Fishers Association (CAMAFA), said illegal methods – including dynamite, cyanide, natural poisons, electrical current – were used before, causing untold damage to the reefs and marine resources. Fish eggs were collected and mangrove trees were used as Christmas decor.

Chua said when the current conservation efforts in Caliling started sometime in 1994, "Only 32 per cent of coral reefs were left not only due to illegal fishing but also because of soil erosion."

This situation was not unique to the Negros village. By 1991 experts were reporting that about 70 per cent of the Philippines' coral reefs were in poor or, at best, fair condition. Excellent reefs comprised only five per cent of the estimated total of 27,000 square kilometres. That is indeed a terrible state of affairs for a country which, with some 7,100 islands, has a shoreline longer than the continental United States.

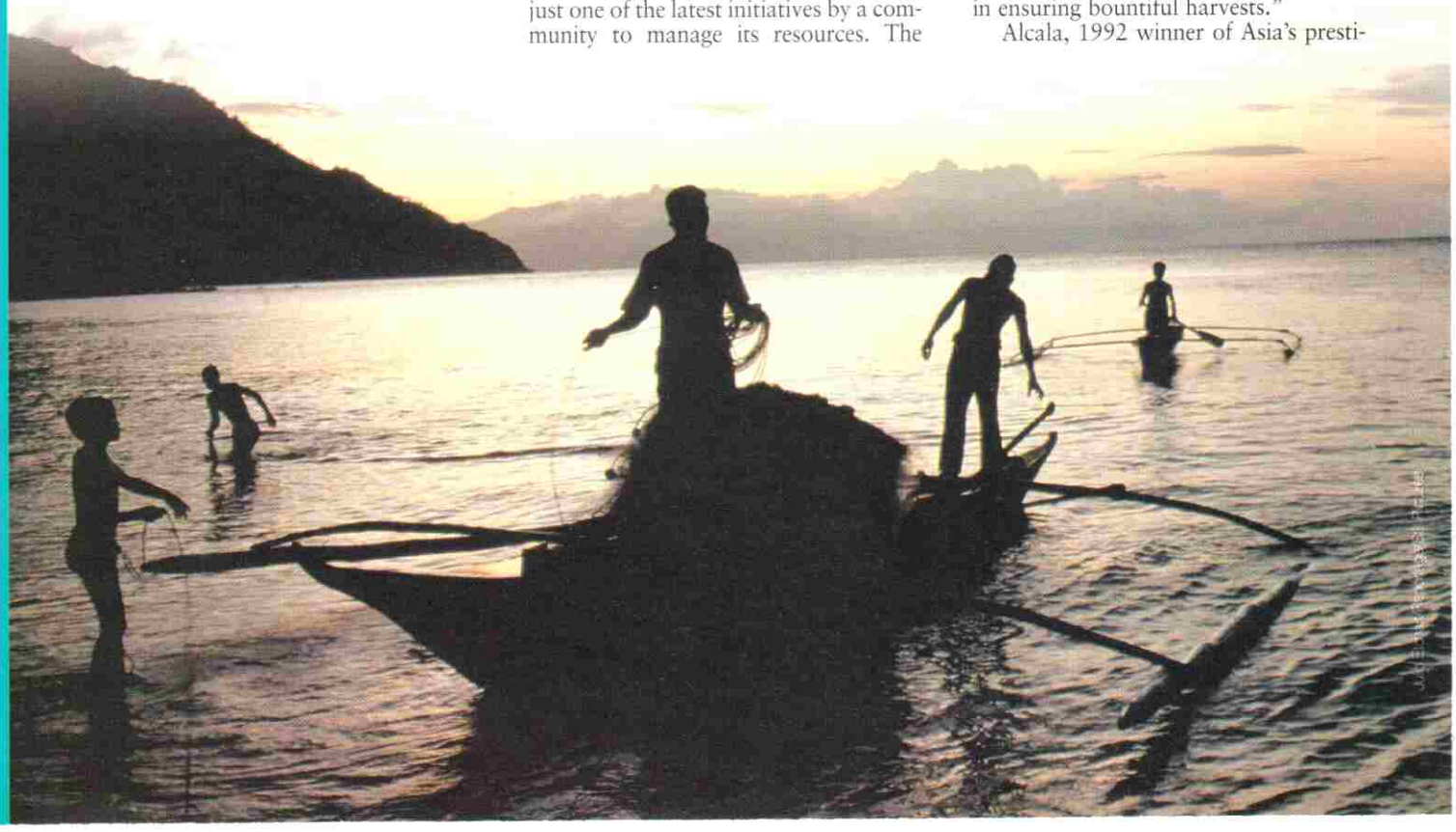
With up to 25 per cent of the country's total fish catch associated with coral reefs and with fish providing more than 50 per cent of the Filipinos' animal protein intake, there was compelling reason to act. Government agencies and non-governmental organizations (NGOs) have both taken steps to solve the problem. But even more significant is the growing trend among local communities to take the initiative in restoring and conserving their natural resources.

What is happening in Caliling now is just one of the latest initiatives by a community to manage its resources. The community has already succeeded in getting the Cauayan municipal board to declare some 200 hectares of the Hulao-hulao (the name of another giant) reef a fish sanctuary. CAMAFA, which has some 50 members, is reforesting the uplands, rehabilitating the watershed, replanting mangroves, carefully policing Caliling's coastlines and building a boat to chase illegal fishers away. It has also launched alternative livelihood activities to help raise members' incomes.

Caliling took its cue from a much-admired initiative on the other side of the island of Negros. In the eastern part of the two-province island, Silliman University, which is based in Negros Oriental's capital city of Dumaguete, has succeeded in getting people to recognize and act on the need to protect and preserve their coral reefs and marine resources.

Getting people's co-operation was not easy. Dr. Angel Alcala, former Silliman president and former secretary of environment and natural resources, said: "The most difficult problem...is to convince the hungry communities (of Caliling) to protect their resources... People have a tendency to cut mangroves or remove corals because of ignorance on the roles of environment in ensuring bountiful harvests."

Alcala, 1992 winner of Asia's presti-



Left: Coral damage caused by boat anchors, Philippines
Main shot: Fishermen, Mindoro Island, Philippines
Below: Child spear fisher with his home-made speargun

d reefs

gious Ramon Magsaysay Award in Public Service for his pioneering work in the rehabilitation of the Philippines coral reefs, talked about such things as how a good coral reef produces 25 tons of fish per square kilometre annually while a destroyed reef yields less than five tons. But lectures could only go so far. As another Silliman faculty member observed, "Inherent in fisher folk is the need to see in order to believe."

What clinched it for Alcala was being able to prove to the Caliling folk that what he was talking about can really come to pass. The marine biologist, who set up the Philippines' first marine sanctuary on Sumilon Island, Cebu, arranged for the fisher folk to visit Apo Island, where Silliman University had persuaded the locals to set up a community-based coastal management programme. Learning from previous experience about the need to involve local people, the Silliman team of professional community organizers, worked hand-in-hand with Apo families from the beginning.

Like Caliling, Apo was in danger of losing its corals due to destructive fishing methods such as explosives and fine mesh nets. Fish catches and, consequently, incomes were declining. As people earned less, the use of destructive fishing methods increased causing even greater damage to the fishing grounds.

The Silliman team initiated in 1985 the community-based Marine Conservation and Development Programme (MDCP), in 1985 to enable local communities to protect and/or enhance their marine resources. The programme included the establishment of marine reserves and sanctuaries. Livelihood projects, environment education activities, community development training, agroforestry and water development schemes, and outreach programmes to get more communities involved were also undertaken.

Now completely in the hands of the local stakeholders, the Apo initiative has proven effective in preserving the coral reef and fisheries surrounding this small island. It has since become both a showcase and a model of successful community-based management programme for other small islands and mainland communities.

By 1992, most Apo fisher folk believed that the marine reserve and sanctuary on their island had significantly improved fishing, serving as a breeding place for fish.

CAMAFA member Leodegario Morales, an upland farmer displaced by insurgency in Negros, recalled their visit: "(There were) a lot of fish in Apo. Corals are protected. (We) saw that it was possible to protect corals and earn a good living. The people there owned appliances and good houses. The community was progressive and they have good schools."

The visitors also saw how conservation earned extra income by making Apo's rich coral reefs a major tourist attraction. Chua said, "We think we will earn more money if we can also attract tourists the way Apo has."

If Apo's community-based project has served as an inspiration to the neighbouring land of the giants, another community-based movement in the Philippines has figuratively slain a giant.

Residents of the coastal town of Bolinao in Pangasinan, Philippine President Fidel Ramos's home province, have successfully barred the opening of a huge Taiwanese-financed cement plant in their community. Assurances by the proponents that the cement complex will not only be the biggest (it was estimated to cost P13.5-16 billion or over US$500 million) but the cleanest in the world did not weaken opposition spearheaded by the Movement of Bolinao Concerned Citizens, Inc. (MBCCI).

Unified front

Helen T. Yap, Professor at the University of the Philippines' Marine Science Institute, says the controversy might have been the first time the community presented a really unified front. However, she believes years of work by the Institute and others to raise the people's environmental awareness helped. The Institute has been in Bolinao since 1980, setting up a marine laboratory there. Its community-based Coastal Resources Management Project (CRMP) conducted educational campaigns on the recent controversy.

Yap recalled that even when they were just starting, they had more trouble selling their work to politicians than to ordinary people, even fisher folk. "People who live on the coast appreciate their resources," Yap said. Thus, the locals readily accepted the laboratory in Bolinao, whose reefs form part of the Bolinao-Anda chain, declared as "environmentally critical habitat" by President Ramos.

Members of the MBCCI consulted with the marine laboratory's scientists, who warned that the cement plant would result in heavy dust fallout and depletion of groundwater. Potential environmental risks, particularly for marine resources, are also posed by increased quarrying, the operation of a coal-fired power plant, and pollution from cargo ships, among others.

MBCCI held rallies and wrote hundreds of letters to government officials, local and foreign NGOs, and the media seeking support for their cause. Virginia Pasalo, chair of the Women in Development Foundation, said, "We had to pray. It was our only chance."

Collaboration between experts and the local communities is also breathing new life into the waters of Guiuan in the central Philippines province of Eastern Samar. With their waters fished almost to extinction, the communities teamed up with the Guiuan Development Foundation, Inc. (GDFI), a social development organization set up by marine biologist Margarita de la Cruz to help fisher folk.

GDFI organized the communities, promoted the use of more environment-friendly fishing methods, and introduced alternative livelihood activities. It asked experts from the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) to assess Guiuan's waters and suggest solutions. On PCAMRD's recommendation, the Bagonbanua Marine Resource Replenishment Project (BMRRP) was set up which served as a model for other marine reserves and sanctuaries in the area.

Similar community-based coastal management projects are now being launched in many parts of the Philippines. Like the ones cited, they are based on the belief that local resident resource users and stakeholders are the real coastal resource managers. Every successful project has, one way or another, transformed those closest to the resources into 'decision-makers' on how best to protect and maintain the reefs, fish stocks, mangroves, and clean marine waters.

The approach is not simple. It is, in fact, quite difficult with many obstacles to overcome like poverty, growing population and weak formal government institutions. Successes, like those mentioned, are characterized by a combination of factors: strong NGOs, improved local government support, responsive donors, effective professional community-level workers and, an increased willingness to try integrated approaches which link various government sectors with NGO and community groups. ■

Linda Bolido is *People & the Planet* correspondent in the Philippines. Alan White is Co-ordinator of the Coastal Resources Management Project (CRMP) in Cebu City.

P. Galera

A little more than one year ago, anyone spending time in the fishing villages near Tanga – a provincial town on the north-east coast of Tanzania, bordering the Indian Ocean – would have heard sporadic blasts from dynamite fishing. Now, thanks to a new initiative, villagers and government officials are working together to save the coral reefs. **Solomon Makoloweka** and **Kath Shurcliff** report.

Silencing the dyna

Dynamite fishing in the villages near Tanga is not a widespread practice, but it is a highly damaging one.

While the few fishermen practising it can collect an unusually high catch of around 30 kg of fish in a few hours, most understand that it is wasteful and that it destroys the coral reefs that many fish depend upon for breeding and shelter. Indeed, most of them would like to see the practice stopped. They believe that the fish do not like the noise and disturbance, and soon leave areas which are constantly blasted.

This and other destructive methods of fishing, coupled with too many people fishing, are seen as the most critical environmental issues facing the people of Tanga. The regional government in Tanga felt it was time to act. They asked the World Conservation Union for technical assistance.

With financial support from Irish Aid, the fisheries, forestry, planning and community development offices joined forces across the three coastal district governments that constitute the Tanga region. Together, these government officers have developed an effective programme to deal with reef fisheries issues.

The programme started in mid-1994, and now just more than two years later: dynamite blasting is rarely heard.

What has led to these changes? The government officials took the approach that if people are causing the problem, then those same people can help solve it. So they started with the fishing villages themselves. They conducted participatory appraisals of which coastal resources are used, what the villagers see as the problems and their causes, and what they think can be done to resolve them.

These appraisals were done by government extension workers questioning villagers and holding discussions with them in small groups. Women were also sought out, as it became apparent that they are very important users of coastal resources, both for everyday needs and for their related small businesses. For instance, in one village, every fisherman supports ten fishmongers, of whom, women outnumber men four to one.

The villagers also contended that lack of enforcement by government officials contributed to the problem. Dynamite fishing was illegal, but what did the government do about those who were dynamiting? Nothing was the consistent reply.

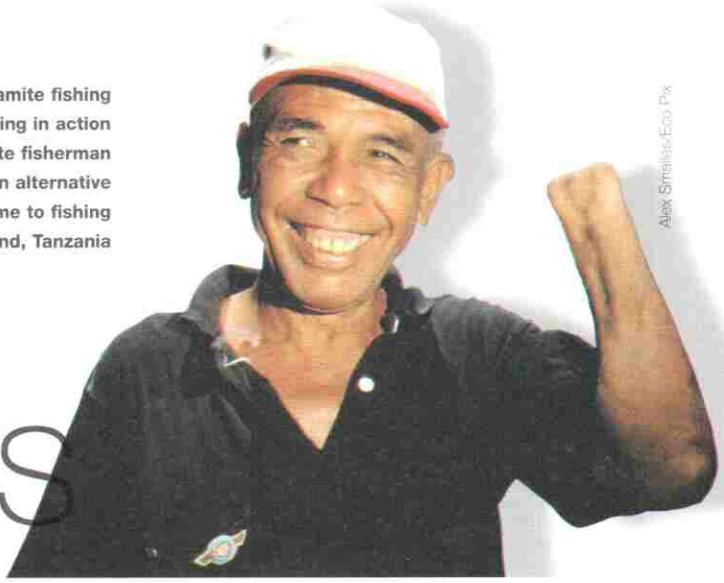
Government officials soon realized that new approaches to dealing with destructive fisheries and improved ways of working together with village authorities had to be found. Several villages decided to form special committees to deal with the problem. They were given some basic training in programme planning – how to do a cause and effect analysis of a problem, turn issues into objectives, plan and timetable actions, and select and monitor indicators to see whether their actions were working.

Lynn Funkhouser/Still Pictures

They concluded that their low fish catches resulted from a scarcity that was directly linked to illegal destructive fishing techniques (of dynamiting and using smallmesh size nets), uncontrolled mangrove cutting, increased demand

Tony Rath/WWF

Left: Aftermath of dynamite fishing
Left bottom: Dynamite fishing in action
Right: Injured dynamite fisherman
Below: Tourists provide an alternative source of income to fishing
Below right: Coral rubble, Mafia Island, Tanzania



Alex Smellie/Eco Pix

mite fishers

for fish, increased numbers of fishers, destruction of coral reefs and breeding sites, and trawlers fishing too close to the coast.

To verify the extent of reef damage, the fisheries officers did a rapid survey of the nearly 100 reefs in the area. They measured the extent of live to dead coral, fish populations, coral and fish diversity.

These surveys were fairly simple to perform; one small fibre glass canoe with outboard engine, snorkels and a Geographic Positioning System were the only equipment needed. They also learnt from the villagers which fishers use which reefs, which reefs are important for different fisheries, and what fishing gears are used for which fish species.

Villagers not only helped to collect this information, they also reviewed the results. The village committees at each of the four different pilot sites identified a number of actions that could be taken to increase fish catches and that would also lead to increased incomes for the fishers.

First, they agreed to establish management areas off each pilot village to test their proposed actions. They then identified suitable areas where they undertook most of their own fishing, and the people who needed to be involved. This included fishers from a number of surrounding villages.

Next they developed a number of principles which should guide the process: fishing pressure should be reduced; resident fishers from the four main villages should all participate in the management activities; management decisions should be taken by the four village governments, with technical advice given by the district and central government fisheries officers; gears and techniques already prohibited by government laws should not be used; and visiting fishers from outside the four villages, should obtain written permission from the village governments before fishing in the area.

These are simple principles, and therefore likely to be effective.

The committees agreed that fishing pressure could be reduced by enforcing the ban on illegal fishing techniques, prohibiting trawling in the coastal area, and reducing the number of visiting fishers. To achieve these results there needs to be both better enforcement of existing laws and creation of new village by-laws.

Enforcement activities have been underway for the last few months. Already, the results are clear. The number of dynamite blasts have been reduced by a factor of ten. Several types of gear have been outlawed at a number of reefs, and their enforcement ensured by the village committees.

The committees work closely with the marine police and fisheries officers to patrol and inspect gears and catches. The new by-laws still require the approval and support of both district and central government authorities, and this process is well under way. The committees also agreed that the fish stocks should be increased and the health of the coral reefs improved. They are trying to achieve this by testing a proposal to close off at least one reef to all fishing. The first reef chosen is in good health now, has high fish and coral diversity and, as it is an outer reef, its closure will not greatly effect elderly fishers who rely upon inner reefs. The committee, with the assistance of government fisheries staff, will monitor the impact of their actions and review their action plans every six months.

The village committees are very serious and committed to these action plans. They have also sought and obtained the approval of the entire village assembly and the approval of three surrounding villages. They have enthusiastically spread their actions and ideas to other nearby villages. These villages now also want to join the programme, and government officials are seeing the advantages of greater involvement of village committees in management actions.

Although there is a chronic shortage of finances to manage resources, there is no shortage of willing, knowledgeable and committed people. Government officials are developing skills to facilitate and co-ordinate village teams, organize and provide technical advice in support of village initiatives and monitor for effective actions and outcomes. They also supply legal and enforcement support to ensure that village actions are recognised and accepted by other users and central government managers, who are not directly involved in the village developments.

Together, the villagers are forging new ways of working with government officials, to achieve better management and enforcement and, more importantly, to perceive each other as allies rather than enemies to meet the challenges of resource sustainability. ■

Solomon Makoloweka is Programme Co-ordinator and Kath Shurcliff is Chief Technical Advisor at the Tanga Coastal Zone Conservation and Development Programme, PO Box 5036, Tanga, Tanzania.

Meg Gawler/WWF

Allan Smith

The coral reefs of the Caribbean are among the richest natural systems to be found in this island region, and their conservation is both urgent and difficult. But success depends on very much on the greater involvement of local communities, says **Yves Renard** and **Allan Smith** who report from St Lucia.

Building a sense of stewardship

There may well be no other part of this world where the relationship between reef conservation and human development is so obvious, and so critical to the well-being of people and their environment, as in the Caribbean islands.

Because of the limited size of many of the islands' reefs, and the inter-relation with other systems, there is virtually no human action – in agriculture, construction, urban development, housing, waste disposal or industry – which does not, eventually, impact on reefs. It is as a result of this impact that many reef formations have been lost, or at least severely degraded. Reviews of the status of reefs in the Caribbean over the past 15 years describe a continuous decline, in most islands in the amount of live coral cover, and the abundance and average size of reef fish.

There is thus a growing concern over the status of reefs in the region, particularly because they contribute significantly to human development. This contribution is most evident in tourism, with the large number of visitors who come to the region to dive and explore the underwater attractions. Reefs also provide the basis for a significant portion of the local fishery in many islands, and play an essential role in protecting shorelines and beaches from erosion by wave action. The health of Caribbean countries, and the health of their coastal communities, are directly linked to the health of their reefs.

Allan Smith

Community participation should, therefore, be an important ingredient in any effort at reversing the trend of reef loss and impoverishment, but there are many obstacles to the involvement of Caribbean communities in the management of the use of

Top: Yachting and tourism in St Vincent, Grenadines
Above: Coral bleaching in the Caribbean
Main picture: Local fishermen, St Lucia

reef resources. Caribbean societies are mainly built on a colonial system based on plantation agriculture and industrialisation for export, and most people have little knowledge and appreciation of marine life generally, and of reef resources in particular. These societies do not have the extensive traditional knowledge and management systems that may be found in other small island regions of the globe. One result of this is the fact that even artisanal fishing by coastal communities has depleted stocks of reef fish in many islands, with the north coast of Jamaica as an example.

Participation is rendered difficult by the absence, in most instances, of strong local institutions capable of organizing and representing the interest of reef users, notably the fishers. Yet, the conditions of people who are dependent on the reefs for their livelihood are worsening, because of a continuing decline in stocks, and because of conflicts generated by new uses, particularly tourism.

Perhaps the main practical argument in favour of a participatory approach in reef management is its potential to overcome the failure of conventional interventions to establish conservation and management measures and regimes. In this field, the Caribbean has witnessed three decades of activity which have left little more than a trail of "paper parks" legally established but non-existent in reality, a pile of management plans and reports collecting dust on the shelves of ill-equipped management agencies, and growing conflicts caused by the frustrations of local people and their

frequent alienation from the resource base and from their traditional practices. Exceptions can, however, be found as in the cases of the British Virgin Islands, Saba and Bonaire, where marine protected areas are actively and effectively managed.

The failure of this "old" approach can be attributed to two main reasons: one is its inability to integrate reef conservation and management into a broader scheme of coastal zone management, and the other is the fact that is does not secure and mobilize the commitment, knowledge and resources of many groups which have a stake in the future of the resource. An alternative approach was therefore needed, and a number of groups and institutions have taken the initiative to address the issues of reef degradation in a different way, placing greater responsibility in the hands of the people who need the reefs most, and who have much to offer in the quest for more sustainable and more equitable patterns of use.

In small islands with scarce resources and multiple activities taking place in the coastal zone, one of the principal challenges is to reduce and manage conflicts among all the parties. This has been the focus of the work carried out over the past four years in Soufriere, on the south-west coast of St. Lucia, where a participatory planning exercise involving all stakeholders resulted in the establishment of a co-management arrangement under the umbrella of the Soufriere Marine Management Area. This experience has demonstrated the need to create channels of communication and negotiation among groups and people concerned, and to create flexible and democratic mechanisms to address new conflicts whenever they arise.

Information is critical to management, and it must come from various sources. Rigorous scientific experimentation and monitoring are essential, and there is much popular knowledge that can be invaluable. Unfortunately, the resources for the necessary research are frequently inadequate. One effective solution to the shortage of trained people is the use of volunteers in gathering data on the condition of reef corals and reef fish populations. This approach is sometimes criticised by the scientific community, but it can be effective. A study of the methods and results of a volunteer programme run by Coral Cay Conservation in Belize, for example, showed that

with appropriate methods, training and supervision, volunteer divers can collect valid data.

Until recently, most coral reef studies were conducted by people from outside the region, with little feedback to the communities and institutions that need the information. There is now an increasing awareness of the need for on-going national monitoring programmes. In Barbados, for example, the government's Coastal Zone Management Unit established such a programme in 1987 to ensure an adequate information base. In Bonaire and Saba, in the Netherlands Antilles, research and monitoring programmes are run and financed by non-governmental organisations (NGOs), with similarly relevant results.

One key to the relative success of participatory programmes in reef conservation in the region is the fact that several of these have been able to develop creative sources of revenue. These include fees for SCUBA diving and yacht moorings. It is to the credit of several governments of the region, including those of the Netherlands Antilles, Jamaica, St. Lucia and the British Virgin Islands, that they have allowed some or all of the revenue generated by marine protected areas to be collected and used by non-governmental institutions.

NGOs are playing a key role in coral reef management, notably in informing, educating and mobilizing communities. In Jamaica, the Negril Coral Reef Preservation Society and the Negril Environmental Protection Trust (NEPT) work closely with local communities on an active environmental awareness programme. On the Playas del Este, not far from the capital city of Havana in Cuba, community groups, organized around the Programa Sibarimar, have created a community museum and have mounted a range of creative educational programmes centred on the importance of coastal resources, including reefs.

A growing number of reef conservation programmes now involve NGOs and community groups in management and enforcement. In Jamaica, NEPT will manage the Negril Marine Park; in St. Lucia, the Soufriere Regional Development Foundation co-ordinates the operations of the Soufriere Marine Management Area; in the Dominican Republic, the Centro para el Ecodesarrollo de la Bahia de Samana y su Entorno (CEBSE) has taken the lead in reef conservation activities in the north-east of the country.

In all these instances, new and creative partnerships are being developed between government agencies and non-governmental interests. In Jamaica, the Montego Bay Marine Park Trust has been given responsibility for management of the Montego Bay Marine Park through an agreement which defines the conditions of a management partnership between government agencies, local community institutions, and the private sector. In St. Lucia, the local Department of Fisheries now collaborates on a daily basis with the wide range of stakeholder groups involved, in one way or the other, in the management of the Soufriere Marine Management Area. Through collaborative management, a large variety of skills and resources are being placed at the service of conservation, in a manner which takes into consideration the needs and concerns of all stakeholders.

With this approach, the Caribbean is slowly inventing a new relationship, building a sense of stewardship, ownership and commitment, and placing the reefs and their future closer to the centre of the development strategies of coastal communities. ■

Yves Renard and Allan Smith are respectively Executive Director and Research Scientist with the Caribbean Natural Resources Institute (CANARI).

Top: Scrawled filefish, Dutch Antilles, Caribbean
Above: Diving to check a sediment trap, St Lucia, Caribbean

Amanda Vincent

A passion for seahorses has dominated the last ten years of Dr. Amanda Vincent's life. She is the first scientist to have successfully studied seahorses in the wild. **Maya Pastakia** tells the story of her struggle to save these remarkable creatures.

Taming the seahorse trade

Dr. Amanda Vincent, Assistant Professor in Conservation Biology at McGill University in Canada, has spent thousands of hours in the underwater world of the reefs, researching seahorses. In the course of this, she has discovered that some seahorse populations have declined by as much as 50 per cent. She believes that the global trade in seahorses, involving around 38 countries, is largely to blame. In the West, seahorses are mainly exploited for aquariums and the dried variety for curios – key rings, earrings and broaches. But the greatest consumer of these mysterious creatures is Chinese medicine.

Seahorses have been used in Chinese medicine for around four to five hundred years. The mystique surrounding these animals has been their downfall. They are sold as if there is no limit to their medicinal powers, from curing heart disease to aphrodisiacs. "The best estimate at the moment is something like 20 million seahorses are used every year in Chinese medicine alone. That's a conservative estimate," warns Amanda.

What concerns the English scientist most is the explosive demand for seahorses provoked by China's expanding economy. Demand is increasing by at least 10 per cent every year and supplies cannot keep apace.

Many of the seahorses that end up in Hong Kong – the centre of the seahorse trade – have come from the Philippines, a thousand miles away. In the village of Handumon, off Bohol, Nestor Botero is one of the fishermen who hunts seahorses. A seahorse around 100-125 mm tall can earn him fifteen pesos, about 40 pence. By the time they get to Hong Kong, they are worth more than their weight in silver. Bleached and dried, seven seahorses weighing just a few grams are worth over £50 – this is big business.

The move from the sale of whole animals to seahorses that are ground-up and used in pre-packaged pills and capsules is further cause for alarm. Pre-packaged medicines mean that smaller and younger seahorses are used – seahorses that in the past would have been unacceptable because of their small size.

Amanda is not one of life's bystanders. She had to do something to save her beloved seahorses and, in January 1995, set off for the Philippines to set up a community-based conservation project.

Nine hundred people live in Handumon and the whole life of the village revolves around the sea. This beautiful area is actually the poorest region of the Philippines and there are few ways to make money. Nester Botero catches small fish to feed his family, but the only way he can earn any hard cash is from seahorses. "I've been fishing seahorses for 18 years. They are very important for my family because I use them to buy food and medicine." Over half of Nestor's annual income comes from seahorses.

Norbert Wu/Still Pictures

But there is a crisis facing the fishermen. From 40 to 50 seahorses a night a few years ago they are now lucky if they catch 15. According to Handumon fishermen, local seahorse populations have declined by about 70 per cent in the past 10 years. And things are getting worse – as they catch younger and smaller seahorses the population is dwindling further. This has serious implications for both villagers and seahorses.

Wary of creating a project run solely by westerners, Amanda brought in Filipino biologists and community organizers from the Haribon Foundation for the Conservation of Natural Resources to help run the project. The fishermen have agreed to show the biologists their seahorses before selling them. This was a simple way of finding out the types and number of seahorses they caught, and where they fished for them. What really worried Amanda was that many of the fishers were bringing in pregnant males and when you take a male and kill him you also kill the young. (In seahorses, it is the male who gives birth to the young).

Now whenever a pregnant male is captured it is placed inside a cage. The male seahorse is only taken away to be sold after he has given birth in the cage. The baby seahorses can simply slip away through the mesh out into the open sea. The sanctuary also protects all other marine species in the area and the fishermen have noticed improvements in all fish catches around the sanctuary.

The seahorse cage helped many more of the young survive, but the only way to take the pressure off the

Michael Pitts

adult seahorses was to set up an area of the reef, where no fishing was allowed. The scheme, which was set up thanks to the support of the 'Captain' of the village, Gregorio Botero, has allowed breeding pairs of seahorses to bear their young unmolested.

Now, seahorse numbers are booming in the reserve and the healthy population within the reserve is helping to replenish whole sections of the reef.

The most recent phase of the project is the most ambitious. The Handumon villagers have started a scheme to farm the seahorses. An underwater corral has been built for a whole seahorse colony to create a constant supply for the trade and buy time for seahorses in the wild.

Meanwhile, news of the Handumon approach to seahorse conservation has reached neighbouring villages which have started to change their own fishing practices and have set up reserves where no fishing for seahorses is allowed. It's the best evidence so far that Amanda's approach does work. A high school scholarship has also been established so that trained locals, Camilo Socias and Cecilia Otarra, will continue the project when Amanda's team leaves.

Looking ahead, however, Amanda believes that protecting just the seahorses is not enough: "We are working very hard to integrate what people need with what the animals themselves need and building a future for both." ■

This article was extracted from the BBC QED documentary *The Secret Life of Seahorses* which won the prestigious Wildscreen 96 award for best environment/conservation film.

★ Dr Amanda Vincent has joined forces with the Zoological Society of London to launch Project Seahorse. For just £20 you can adopt a seahorse species. Money for the adoption will go to helping Amanda's conservation work. For more information, send an s.a.e to Project Seahorse c/o London Zoo, Regent's Park, London NW1 4RY

Above: Amanda Vincent diving with friends
Main picture: Seahorses make the most faithful of partners

Yvette Tavernier/Still Pictures

Coral reefs and the World Bank

As a leading international development institution and the single largest funding source of environmental projects in the world, the World Bank has a strategic role to play in helping reverse current trends in the loss of coral reefs and the multiple benefits they provide, writes **Marea Hatziolos**.

The Bank's involvement in coral reef conservation is part of a larger effort to promote the sound management of coastal and marine resources. It has three major thrusts: partnerships, investments, networks and knowledge.

Partnerships

As an initial partner and early supporter of the International Coral Reef Initiative (ICRI), the Bank serves on the executive planning committee of ICRI and is committed to its objectives. It has engaged Ministers of Finance and the Environment of major coral reef countries in discussions about ICRI and the Bank's interest in supporting investments in coral reef conservation and management. In June 1995 it hosted a major workshop on Sustainable Financing Mechanisms for Coral Reef Conservation.

In a long-standing partnership with the World Conservation Union (IUCN) and the Great Barrier Reef Marine Park Authority (GBRMPA), the World Bank is promoting efforts to establish and maintain a globally representative system of marine protected areas to conserve sites of high biological diversity, which may also include important social and economic values to local communities dependent on these systems. Many of these sites include high concentrations of coral reefs and associated ecosystems.

An initial priority-setting phase in which existing and proposed marine protected areas were mapped in the18 marine regions of the world was completed in 1995 with the publication of a four-volume report, *A Global Representative System of Marine Protected Areas*. Projects are now being developed with support from the Global Environment Facility (GEF) under its Biodiversity Programme.

Investments

In partnership with the GEF, the Bank currently has been supporting coral reef conservation efforts in Jordan, Egypt and the Seychelles. Several major new projects totalling over US$120 million are now in preparation, including the Coral Reef Rehabilitation and Management Project in Indonesia (approximately $100 million), the Coastal Resources Management Project in Thailand, which includes marine protected area management in a number of coral reef sites ($17 million), the Second Environment Program Implementation Project in Madagascar (including $6 million for coastal and marine resources management) and a Marine Biodiversity Conservation Project in Mozambique (approximately $4 million). The Bank, in partnership with UNDP and UNEP, is also completing a Strategic Action Program for the Red Sea and Gulf of Aden with GEF support.

Networks

In line with the development challenges of the future, the Bank is moving toward a 'Knowledge Bank' that will market ideas and knowledge to its clients along with investment projects. The aim is to put the best global knowledge on environmentally sustainable development in the hands of its staff and its clients.

As part of this initiative, information on a variety of topics, from best

Norbert Wu/Still Pictures

practice in integrated coastal zone management and marine protected area management, to terms of reference for the design of project components, mapped information on biodiversity and critical habitats, and links to a host of other relevant data bases will be available on web sites maintained by technical staff in the Bank.

The Bank is reviewing a proposal from the Australian Institute of Marine Science to develop a user friendly, interactive electronic information system that would allow users to identify specimens of reef building corals from around the world and to map their distribution. *CoralBase* would be available to researchers on CD ROM or on the World Wide Web.

In celebration of 1997 as the International Year of the Reef, the World Bank plans to co-sponsor an associated event at its annual Environmentally Sustainable Development Conference, highlighting the importance of coral reefs and urging immediate action to halt their degradation and to conserve these unique ecosystems – essential to sustaining *life* and livelihoods around the world. ■

Marea Hatziolos is a Coastal and Marine Resources Specialist at the World Bank.

seacide

Captain Clive Kelly, an English ecologist and film-maker, has been sailing the oceans for last 40 years. Through his 17-metre ocean-going trimaran, *Survival*, which doubles as a floating ethno-eco Indian museum, he also works to draw attention to 'ecological crimes' of the sea. Here he describes a few disturbing examples.

A couple of years ago we were following the 'bleach trail' from Nassau in the Bahamas to the outer islands. My suspicions were confirmed. The large 50 gallon drums of bleach which were being unloaded from cargo boats at Nassau were reduced to one gallon plastic containers for use by the lobster fishermen. They dive down using the prohibited 'hooker' oxygen supply system (an underwater breathing pipe) driven by a gasoline motor in a small supply boat above.

The bleach is squirted into the upstream holes of the *millenaer* reefs turning the inside caverns – home to much marine life and the succulent, tasty, expensive lobster – into a gas chamber. Life either escapes or dies from asphyxiation. It is not rare for these killer fishermen to earn many thousands of dollars from each reef. It is just a matter of finding the right lobster hotel.

The reefs remain burnt, black, charred. Ruined. A creation of millions of years destroyed in a matter of seconds. Blast fishing, acidic fluids, drift nets and plastics are eliminating our marine life and their habitats.

During my travels along the sea of Ilha Bela, São Paulo, Brazil, I came across a sea turtle weighing 14 kilos dead on the beach. On opening it up, I found 3 kilos of plastic, including, a balloon with the design of the USA flag, 3 condoms, 4 metres of purple plastic ribbon running through the turtle's intestine, a plastic bag, hundreds of pieces of fishing line, a 6-inch red plastic flower, several pieces of plastic sandal, 2 combs, lots of plastic packing balls, pieces of plastic bottles and pieces of Coca-Cola advertising.

I have also recently photographed fish with condoms stuck in their throats, blocking their mouths. A full condom looks like a juicy squid to a hungry fish. Sometimes the fish is in the pan minutes later or even eaten raw. The risk of infection seems obvious.

Only education can end such 'seacide'. ■

The ethic of coastal care

The predicament of the world's coral reefs provides a powerful parable for the downward spiral in the condition of coastal ecosystems worldwide, say **Stephen Olsen** and **Magnus Ngoile**, in this thoughtful 'last word' on the subject.

Responsible action to stop the decline of coral reefs must be taken locally, regionally and globally, and it must involve multidisciplinary science with effective management. These forms of integration, it is now clear, lie at the heart of the emerging practise of coastal management.

In the tropics, where the process of degradation is accelerating, there is an urgent need for effective action at the local level. How can reefs be protected from overuse and from the local threats of water pollution, siltation and overfishing?

Apo Island, in the Philippines is a well known example of success at the local level. A key factor in this is that the local municipality supported the islanders when they created a small sanctuary in which fishing is prohibited. By sharing a portion of a visitor fee with the community and through the sale of local products to tourists, some of the equity problems posed by tourism have been addressed.

But often the causes of degradation are not entirely local. If the source of the "seed" of reef organisms that maintains a reef is some distance away upcurrent, or if silt is coming from logging operations far inland, local action will yield few results.

Reefs are also threatened by actions of our species that play out at the global level. Most tourists who travel great distances to enjoy first hand the 'goods and services' of reefs in such diverse places as Kenya, Mauritius, Thailand and the Caribbean come from wealthy nations in the temperate zones. Other global pressures come in the form of trade for live fish for up-market Asian restaurants and for aquariums in Europe and the United States.

These pressures affect reefs directly – by direct overuse as when tourists trample reefs, and sometimes by discouraging local efforts at conservation when the pressure of global market demands overwhelms attempts at responsible action. Action is needed, therefore, at all levels.

What to do? Coastal management offers a philosophy and techniques for dealing with such problems. It holds the promise of being a stepping stone towards effectively governing the behaviour of human societies as this relates to the qualities of coastal ecosystems.

The central idea is that human societies should be analysed, and public policy defined, as one of the many interlinked processes by which ecosystems function and change. This view requires a degree of humility and a level of integration that has been absent from the ideas that have historically shaped our increasingly homogeneous world culture. Ecosystem management requires that people are viewed inside ecosystems, as part of them, and not somehow independent of them.

A benefit of ecosystem-based approaches to management is that they demand a long-term perspective. The concept of making decisions in the light of their unlikely impacts on future generations, becomes important because so many of the ecosystem processes at work play out over decades rather than the few years or months that frame business cycles that often demand a quick return on investment.

What is happening to coral reefs powerfully illustrates the importance of carefully answering the fundamental question that coastal management works to address. "What's the problem?" and "What's the goal?' We are learning that the fundamental impediment to improved coastal management is not a lack of information. Much of the research that has and continues to be conducted on coral reefs is of marginal help when trying to answer these two questions. we already know enough to conclude that in the great majority of cases the causes of reef degradation are people.

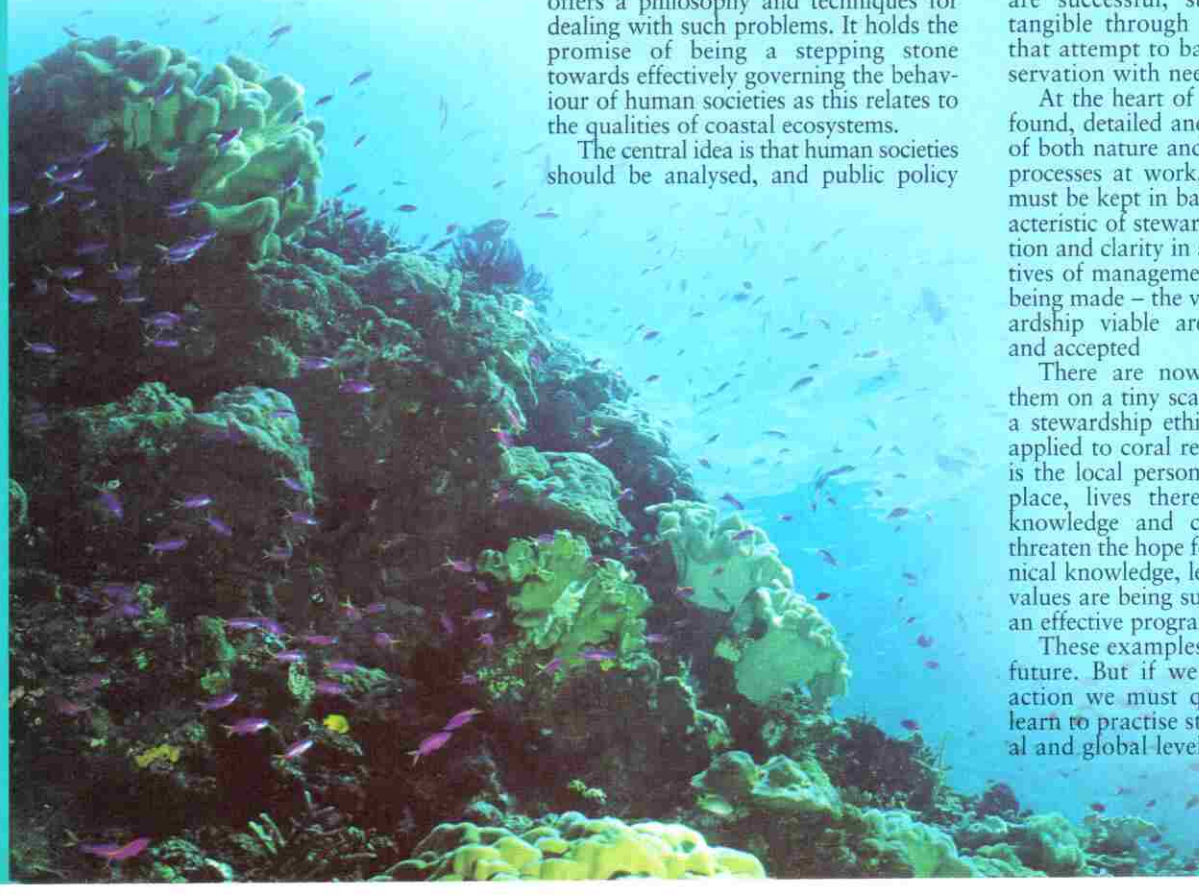
The key lies in bolstering the societal values that can lead to the changes in human behaviour at all scales. Reef management is primarily about managing people – a cliché whose obvious truth is still too often ignored.

The information and ideas contained in this issue suggests that a stewardship ethic lies at the heart of any long term and potentially sustainable response to the degradation of coral reefs. Where coastal management initiatives are successful, stewardship is made tangible through policies and actions that attempt to balance needs for conservation with needs for development.

At the heart of stewardship is a profound, detailed and accurate knowledge of both nature and society, of the many processes at work, and the values that must be kept in balance. A second characteristic of stewardship is careful attention and clarity in articulating the objectives of management. Where progress is being made – the values that make stewardship viable are widely understood and accepted

There are now examples, most of them on a tiny scale, that illustrate how a stewardship ethic can be successfully applied to coral reefs. Here the steward is the local person. He or she is of the place, lives there, and applies local knowledge and confronts those who threaten the hope for balance. Here technical knowledge, leadership and a set of values are being successfully woven into an effective programme of action.

These examples give us hope for the future. But if we are to see effective action we must quickly scale–up and learn to practise stewardship at regional and global levels. ■



Alex Smailes/Eco Pix

POPULATION MATTERS

In the light of recent cutbacks by the United States government in population funding, Population Action International (PAI), has produced an informative easy-to-use publication entitled *Why Population Matters*.

The publication argues that current rates of population growth pose a significant and interacting risk to human well-being. And, in an effort to state the demographic case for US assistance to international population programmes, this publication brings together and summarizes the reasons why all people should care about population issues.

Why Population Matters is organized into easy-to-read sections including:

★An introduction addressing the purpose of the publication and describing the realities of population programmes;

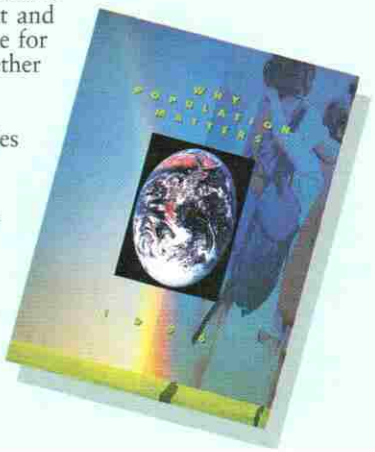
★ A section detailing population facts and figures; and

★ Three sections of "key reasons" describing the impact of continued population growth on economic development, on the environment, and on safety and health.

The arguments this publication puts forth will be useful anywhere in discussions of the wisdom of addressing population growth through access to family planning, education for girls and economic opportunities for women.

The publication will be revised for more universal relevance in other countries.

Contact: PAI, 1120 19th Street NW, Suite 550, Washington DC 20036, USA. Tel: (+1 202) 659 1833, Fax: (+1 202) 293 1795.



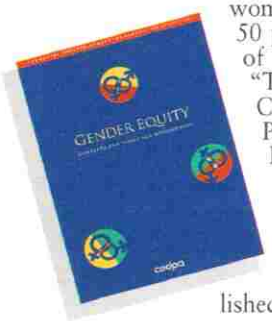
GENDER BALANCE

In an effort to help development professionals create and carry out gender-focused projects, The Centre for Development and Population Activities (CEDPA) has published *Gender Equity: Concepts and Tools for Development*.

The 48-page booklet provides an overview of the rapidly changing field of gender and development and introduces gender analysis and training. The most complete action plan on gender, the Platform of Action adopted at the Fourth World Conference on Women in 1995, is summarized. The booklet can be used as a general introduction to the field of gender-focused development and in conjunction with the CEDPA training manual, *Gender and Development*.

Gender roles generally have a repressive impact on women and have restricted their participation in the development process, said Peggy Curlin, President of CEDPA. Women now constitute 70 per cent of those living in poverty, hold 40 per cent of paid jobs, and are often paid half as much as men for work of equal value. Globally, only 10 per cent of the members of legislative bodies and a smaller percentage of government ministers are women. Seventy per cent of out-of-school children are female, as are 66 per cent of primary school drop-outs.

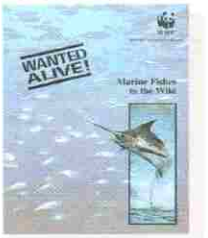
As an indication of unequal sexual relationships, sexually transmitted diseases and HIV are increasing most rapidly among younger women. In 1985, women comprised 10 per cent of those with HIV, in 2000, it is predicted that women will comprise 50 per cent or more of those infected. "The International Conference on Population and Development in Cairo and the Fourth World Conference on Women in Beijing established the importance of gender and equity in sustainable and just societies," said Ms Curlin. "We must now ensure that men and women fully and equally participate in their societies."



The booklet is available for $13.00, including postage to Northern countries and $5.00 in Southern countries (for postage and handling). Development organizations in Southern countries can receive a single copy without charge by contacting CEDPA, 1717 Massachusetts Avenue NW, Suite 200, Washington DC 20036, USA.
Tel: (+1 202) 667 1142,
Fax: (+1 202) 332 4496,
Email: pubs@cedpa.org

MANAGING THE SEAS

The World Wide Fund for Nature (WWF) is working with other conservation organizations and seafood companies to develop a Marine Stewardship Council (MSC) on the lines of the Forest Stewardship Council established by WWF to promote market-led solutions to the world forest crisis.



More than 100 companies and retailers throughout the world have made commitments to buy only timber certified as coming from well-managed forests. Now the aim is to find similar ways of certifying sustainably managed marine fisheries.

A steering group will overlook the work of a project team which will draft the broad set of principles for sustainable fishing, that will underpin the MSC, drawing on existing standards and guidelines and other expertise. It is hoped that the Council can be created later this year.

The urgency of this work is spelt out in the latest of WWF's Species Status Reports on *Marine Fishes in the Wild*, by Elizabeth Kemf, Michael Sutton and Alison Wilson.

The report sets out 10 steps that are needed to save the world's fisheries and rescue marine ecosystems and the millions of people that depend on them for food and employment. This will require the same public concern that outlawed commercial whaling and banned the ivory trade, say the authors. "That won't be easy" they add, "fish neither sing like whales nor look like pandas." But it must be done.

The WWF Species Status Reports are available from WWF International, Avenue du Mont Blanc, CH-1196 Gland, Switzerland.
Tel: (+41 22) 364 9111,
Fax: (+41 22) 364 5358

BORN IN THE USA

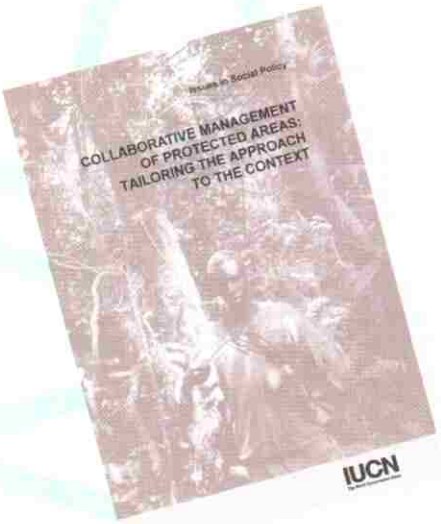
American fertility rates still remain higher than in much of the industrialized world, says a recent Population Council book, *Fertility in the United States: New Patterns, New Theories*.

Women's participation in the work force has increased, yet fertility rates have remained unchanged or have risen slightly, despite inadequate support for working mothers. "While economic factors go a long way toward explaining major trends, we still have no fully satisfactory explanation for changes in fertility in the US," says Population Council demographer John Casterline, co-editor of the book.

Nineteen authors from various disciplines, including economics, sociology, anthropology, and psychology, contributed articles to the book, which was based on a September 1994 workshop organized by the National Research Council's Committee on Population and published as a supplement to the Council's journal *Population and Development Review*.

Fertility in the US is US$ 20.00 for individuals and organizations from a developed country and free for those from developing countries. For subscription information contact: The Population Council,
One Dag Hammarskjold Plaza,
New York, NY 10017, USA.
Tel: (+1 212) 339 0514,
Fax: (+1 212) 755 6052

Books



MANAGEMENT CHALLENGE

Collaborative Management of Protected Areas

Grazia Borrini-Feyerabend

IUCN, 1996

This useful book focuses on the processes, challenges and impediments to establishing partnerships between an agency and various stakeholders interested in sharing management control over various types of protected areas.

Throughout the text Borrini-Feyerabend cautions that such agreements need to be tailored to the specific conditions and needs of different protected areas and societies. And a number of potential obstacles and costs must be faced before embarking on the long process of negotiating specific agreements between institutions vested with management control and the multiplicity of institutions, social groups and individuals possessing a significant stake in the future of a particular protected area.

The author spells out a series of useful questions manager's and citizen's groups might ask before embarking on the long and potentially conflict-ridden process of developing collaborative management agreements.

She also provides numerous examples from both northern and southern countries which show what can be achieved.

Mark Freudenberger

Dr Freudenberger works for the US-based World Wildlife Fund.
This free publication (northern countries pay postage only) is available from IUCN, Social Policy Group, Rue Mauverney 28, CH-1196 Gland, Switzerland: Fax: +41 22 999 0025, Tel: +41 22 999 0001.

COASTAL RICHES

Coastal Zone Management Handbook

John R. Clark

Lewis Publishers, New York, London, Tokyo, 1996, $50.00

This is nothing less than a complete and thorough discussion of what everyone should know about coastal areas by noted marine biologist and author John Clark. It covers virtually every relevant topic in the broad field of coastal area management.

The book is divided into four easy to use sections: Management Strategies; Management Methods; Management Information; and Case Histories. Although intended for use as a text book, its extensive discussion of coastal issues and the rich variety of examples makes this book an excellent reference work.

Since the Hand-book covers so much ground, those looking for information on successful management plans for coral reefs need to dig deep. But there are excellent examples of coral reef management programmes in the Case Histories section.

In addition, the book is noteworthy for its extensive discussion on the interlinkages between critical coastal ecosystems - especially mangrove forests, seagrass beds and coral reefs. It should be required reading for anyone concerned with marine issues.

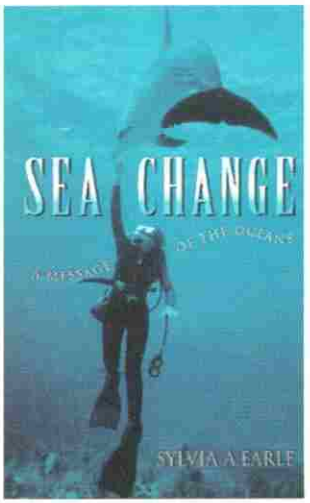
Don Hinrichsen

CRUSADE FOR THE SEA

Sea Change:
A Message of the Oceans

Sylvia Earle

Constable, London, 1996, £18.95



Reef Fisheries:

N.V.C. Polunin and C.M. Roberts

Chapman and Hall, London, 1996, £75

While the discovery of water on the moon makes international headlines, vast tracts of our planet, the deep oceans, remain largely ignored and uncared for.

Sylvia Earle is a scientist of international renown who dedicated her professional and personal life to exploring the depths. Her book is both an odyssey of discovery and an entreaty for a 'sea change' in our attitude to a global life support system.

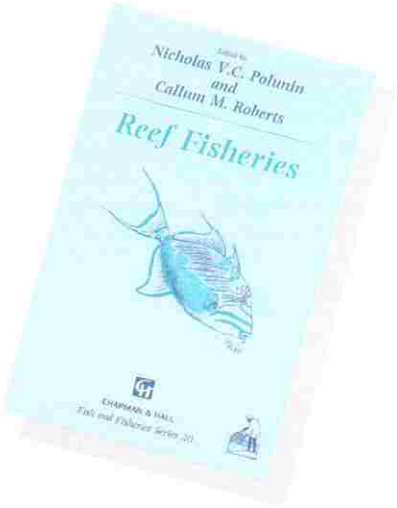
This enthralling account moving from a copper sponge diver's helmet, to experiments in living underwater and the design of vehicles to journey to the abyssal depths is interspersed with natural history, suffused with politics but always anchored in a passionate concern for life in the sea.

The book trawls the Tokyo fish market where more than a million sea creatures are sold each day, challenges our perception of the ocean as a bottomless resource, decries the almost unimaginable proliferation of garbage that has occurred within one generation's memory and draws a hellish portrait of oil pollution from the fires of Kuwait.

Earle's crusade is to banish the ignorance in our land-based society which allows this wanton destruction. Her book encourages a new and wider understanding of our marine heritage.

Coral reefs typify human dependence on the marine environment. The current global reef fish catch is around six million tonnes per year and represents up to 25 per cent of total fish landings in some countries, providing indispensable protein for coastal populations. In the Philippines, for example, an area of just 68 square kilometres supports 17,000 livelihoods. These fisheries are usually small-scale and often provide a last resort income in times of poverty; however, they have generally suffered a dismal management record.

Reef Fisheries, edited by Polunin and Roberts, brings together fisheries scientists, ecologists and sociologists in the kind of integrated approach that Sylvia Earle might advocate and



which is essential to understand these systems. The book covers all aspects of fisheries from egg production to management institutions, with chapters on fish biology, socio-economics, and human ecology. Information previously only to be found in unpublished management reports is synthesized into one volume.

Whilst the text is aimed at researchers, managers and students in this field it will be accessible to non specialists with an interest in these fragile ecosystems.

Maggie Watson

Maggie Watson is a research associate with the International Centre for Living Aquatic Resources Management, in the British Virgin Islands.

Films

Marilyn Kazmer/Still Pictures

CORAL CRUNCH

Dynamited, poisoned, quarried and sold, the coral reefs surrounding the 7,000 islands that make up the Philippines are being badly damaged. Directed and produced by Lenora Carey, *Coral Triangle*, a 52-minute documentary film, assesses the pressures put on the country's most valuable resource by a population of 58 million.

Masked fishermen use cyanide to stun brightly coloured fish for the aquarium trade. Daring divers catch venous sea snakes for their skins: already three species are locally extinct. And in a spectacular underwater sequence, a group of young Filipino boys drive brightly-coloured shoals of fish into huge underwater nets, in the dangerous technique known as *maru ami*, or chamber-net fishing.

But much could have been done to help sustain the treasures of the reef, the film argues, if importers and tourists observed international regulations on endangered species.

A second 28-minute film from TVE also focuses on coral reefs. Thriving in nutrient-poor water, one reef may support over one hundred different colourful species of coral, as well as a wide variety of fish which feed on the algal turf covering the porous reef structure. Yet in recent decades this precious resource has become increasingly threatened.

Entitled *Coral Reefs*, this beautifully filmed documentary, directed by Karen Loveland and Robert Pierce, focuses on a pioneering research project undertaken in the Caribbean by the Smithsonian Institute. The project has contributed a great deal to our understanding of reef ecosystems and the critical role they may play in providing future food supplies for the world.

Rob Gill

TVE's new film catalogue, Moving Pictures 6 is now available on-line. The new service can be accessed via TVE's Web site: http://www.oneworld.org/tve

Contact the TVE Distribution Office at:
TVE, Prince Albert Road,
London NW1 4RZ, UK.
Tel: +44 (0) 171 586 5526,
Fax: +44 (0) 171 586 4866,
Email: tve-dist@tve.org.

EVERYONE'S CHILD

This moving, beautifully shot and acted feature film, is the latest to come from the Media for Development Trust in Zimbabwe, whose producers have pioneered a genre of African drama that has proved both popular and successful.

Everyone's Child tackles the huge problem of the orphans of AIDS, with a lightness of touch and a warmth of spirit that makes the film both entertaining and uplifting. It focuses on the lives of two village children whose father and mother die, leaving them to face a strange world of adult responsibility.

One, a boy takes off to the city, only to find a hostile world of violence and crime. The other, a teenage girl with two younger children to support, falls into debt at the local store and succumbs to the blandishments of the male storekeeper, much to her own sorrow and disgrace.

The ensuing tragedy, and the final triumph as her true love and the community rally round, is told through some fine acting and with telling touches of direction by Commonwealth Literature Prize winner, Tsitsi Dangarembga. Her achievement is all the more remarkable as this is her first feature film.

The project was the brainchild of Jonny Persey, who also co-produced it with funding support from the British Overseas Development Administration and others. The ODA deserve praise for backing such an imaginative film which will give heart to all those battling against AIDS in Africa.

John Rowley

Everyone's Child (and a shortened version and sound track) may be obtained from Jonny Persey at 47 The Ridgeway, London N3 2PG. Tel: (+44) 181 346 7689, Fax: (+44) 181 346 3160, Email: jonpersey@aol.com or from the Media for Development Trust at 135 Union Avenue, PO Box 6755, Harare, Zimbabwe,
Tel: (+263 4) 733364/5,
Fax: (+263 4) 729066,
Email: mfd@mango.zw

VIDEOS IN DEMAND

The first four *People & the Planet* videos are in great demand. Copies have been ordered by more than 200 TV stations and non-government organizations in 50 countries.

All four 26-minute videos are available in English, French and Spanish versions from TVE at the address given above.

The four titles are **Investing in People** (showing the importance of community participation in successful environmental projects), **Victory for Women** (on the outcome of the Cairo Population Conference), **Learning for Life** (on the education of women and girls) and **Calling the Shots** (on how women are finding new ways of communicating).

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People & the Planet

Our next issue will report on health and the environment.

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Volume 1 Number 1/2
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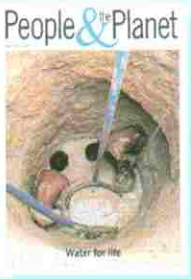
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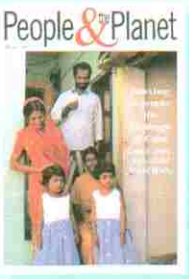
Volume 3 Number 2
Families in a changing world


Volume 3 Number 3
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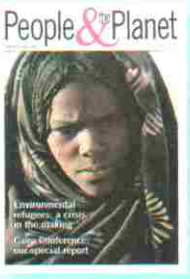
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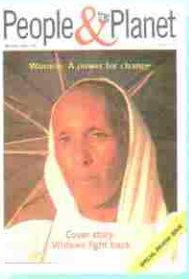
Environmental refugees

Volume 4 Number 1
A world of waste

Volume 4 Number 2
Lakes & inland seas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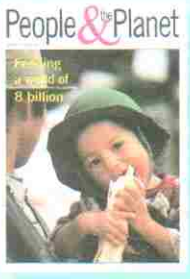
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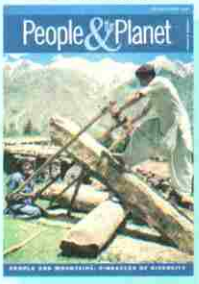
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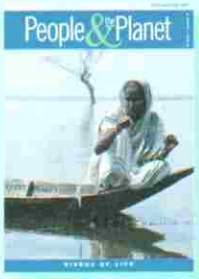
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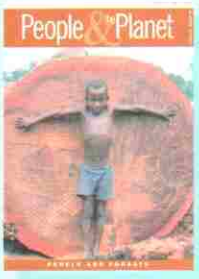
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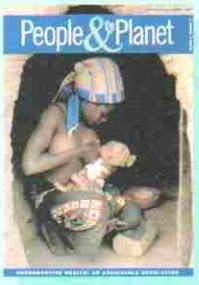
Volume 6 Number 1
Reproductive health

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